

**FRANK H. DOTTERWEICH  
COLLEGE OF ENGINEERING**

# FRANK H. DOTTERWEICH COLLEGE OF ENGINEERING

Stephan J. Nix, *Dean*

John L. Chisholm, *Assistant Dean*

Patrick Mills, *Dotterweich Chair*

Sheryl L. Custer, *Executive Assistant to the Dean*

Mariselda DeLaPaz, *Director of New and Transitioning Students*

Engineering Complex 301. MSC 188. Extension 2001.

Web Site <http://www.engineer.tamuk.edu>

## **Mission Statement**

The Frank H. Dotterweich College of Engineering at Texas A&M University-Kingsville is dedicated to recruiting the highest caliber students, retaining them through guidance and direction and graduating degreed engineers and scientists who will compete and be recognized in a global society. To further fulfill this mission, an ongoing, self-evaluation process will include an active recruitment program of faculty and staff who will not only be recognized nationally for their expertise, but also for their ability to impart to students the most needed skills to function in a competitive work environment.

The Frank H. Dotterweich College of Engineering comprises the following academic units:

- Department of Civil and Architectural Engineering
- Department of Electrical Engineering and Computer Science
- Department of Environmental Engineering
- Department of Industrial Technology
- Department of Mechanical Engineering and Industrial Engineering
- South Texas Environmental Institute
- Wayne H. King Department of Chemical Engineering and Natural Gas Engineering

The college offers basic level programs leading to the Bachelor of Science degrees in chemical engineering, civil engineering, electrical engineering and mechanical engineering. These engineering programs are accredited by the Engineering Accreditation Commission of ABET (111 Market Place, Suite 1050, Baltimore, MD 21202-4012; Telephone number 410-347-7700). The college also offers programs leading to the Bachelor of Science degrees in architectural engineering, computer science, environmental engineering and industrial technology.

The basic level engineering programs are designed to give the student an understanding of the fundamental principles underlying engineering science and engineering practice. Each curriculum contains basic courses to develop a solid foundation in mathematics, chemistry and physics and includes a general background in humanities and social sciences. Building on this background, the engineering science courses provide application of basic principles and the analysis of engineering systems. The engineering design component of the curriculum in each area provides the engineering student with methods and techniques for the solution of technological problems of society.

The curricula in architectural engineering, computer science, environmental engineering and industrial technology are similarly structured to provide the students a solid base in their field.

The laboratory facilities are equipped to facilitate learning. Students will become familiar with the instruments, procedures and processes employed in industry. A computation center is available for students' use throughout their course of study.

The college offers programs of study leading to both the Master of Science and the Master of Engineering degrees along with a Ph.D. in Environmental Engineering. Individuals interested in graduate programs should review the requirements listed in the graduate catalog.

## **Entering Freshmen**

Entering freshmen are required to have a minimum composite score of 21 on the ACT or 970 on the SAT. Students whose test scores fall between 18-20 (ACT) or 810-969 (SAT) will be placed in the Pre-Engineering (PPEN) major status in order to complete preparatory course work. PPEN students must take GEEN 1201. The student will be transferred to an engineering

program after successfully obtaining an overall cumulative and math/science GPA of 2.0 in the second semester of course work. (Course work in math and science must include MATH 1348 or higher and CHEM 1111/CHEM 1311.)

Students who fall below the minimum pre-engineering test score (ACT-18/SAT-810) will not be allowed entry into the college until an overall, cumulative and math/science GPA of 2.5 or better has been attained. Once this criteria has been met, the student may reapply for admission to an engineering program.

### **Transfer Students**

Transfer students will be accepted in the college unconditionally if their overall grade point average from the previous institutions is a 2.5. A&M-Kingsville students desiring to change their major to engineering must also meet this requirement.

Non-engineering majors may take one lower level (1000-2000) engineering course a semester. Upper level engineering courses (3000-4000) may not be taken by non-engineering majors. Exceptions to the above policy must be approved in writing by the dean of the student's college and the dean of engineering. Students who enroll in engineering courses without approval will be dropped from the course.

Students who transfer into the Frank H. Dotterweich College of Engineering from another college within this institution that have a cumulative GPA of 2.0-2.49 on a 4.0 grading system will be placed into our Pre-Engineering (PPEN) major. After two semesters (Fall/Spring), the student will be re-evaluated by his/her adviser. If the student has maintained satisfactory progress, the student will be transferred out of PPEN and placed into a regular engineering major. A special change of major form will be completed and signed by the adviser, the chair of the department and the dean of the college. Students who do not achieve satisfactory progress will remain in PPEN and will be re-evaluated again after the completion of one (1) academic year.

Students planning to transfer to the Frank H. Dotterweich College of Engineering from another four-year university should apply for admission as early as possible. Once accepted, the student is encouraged to contact the appropriate department chair during the semester prior to enrolling at A&M-Kingsville. Course transferability and course prerequisite requirements can be determined to allow a smooth transition into the program at A&M-Kingsville.

Community college transfer students should complete English, mathematics and science courses as early as possible. The basic engineering courses required for a specific degree should also be completed. If some of these courses are not available at the college the student is attending, early transfer or a summer session at A&M-Kingsville may be advisable to enable the student to stay on schedule.

Specific articulation and joint admission agreements are available for several community colleges. These agreements can be viewed on the college's homepage at <http://www.engineer.tamuk.edu>.

### ***Transfer of Credit***

The university has established course equivalencies from the majority of Texas community colleges and universities. The Texas Higher Education Coordinating Board has established guidelines on course transferability from two-year colleges to four-year universities in engineering. In addition to the university policies controlling the granting of credit for course work taken at other institutions where equivalency has not been established, the following policies apply to students entering the Frank H. Dotterweich College of Engineering from such institutions:

- a. All courses taken at another institution are subject to approval by the dean of the Frank H. Dotterweich College of Engineering and the chair of the degree granting department. Courses are approved on a course-by-course basis to ensure their acceptability in fulfilling requirements for a degree. In making this evaluation, the student may be required by the dean and/or department chair to produce catalogs and other supporting material from the institution from which the student is transferring.
- b. All passing grades will be accepted from students transferring under a Joint Articulation Agreement. For all others, degree credit will not normally be granted for any course taken at another institution in which the student's grade in that course was not the equivalent of at least a C and an overall 2.0 on a 4.0 grading system.

A maximum of 72 semester hours may be transferred from institutions that do not have engineering programs accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET). Advanced (3000- or 4000-level) engineering courses from four-year institutions that do not have ABET accredited programs may be applied toward degree requirements only if approved by the department chair and the dean.

The student is responsible for timely processing of all course substitutions. This action should be completed during the first semester of work at A&M-Kingsville.

### **Academic Counseling**

Students are assigned to an academic adviser in their major department upon entering the Frank H. Dotterweich College of Engineering. Academic counseling and preregistration sessions are scheduled each semester to allow students to review their academic progress and plan their schedule for the next semester. All pre-engineering and engineering students are assigned an adviser. Students are required to see their adviser before they will be permitted to register. Students should also consult their adviser for approval of academic matters such as choice of electives, course substitutions, course overloads and adding or dropping courses. The dropping of key courses in a curriculum may delay the student's progress toward the desired degree.

### **Laboratory Fee**

For each laboratory course a fee of \$2 to \$30 is charged depending upon cost of materials used in the course.

## **Requirements for the Bachelor of Science Degree in the Frank H. Dotterweich College of Engineering**

The basic requirements for the Bachelor of Science degree is 120-131 semester hours of academic work, depending upon the career field chosen. Students coming from high school with adequate preparation will be able to satisfy this requirement in eight semesters. Students requiring preparatory work or choosing to take lighter loads will take longer to complete degree requirements.

Engineering is a rapidly changing profession and the departmental curricula are updated continuously to keep pace with these changes. Students entering under this catalog will be required to comply with such curriculum changes in order to earn their degree. However, the total number of semester hours required for the degree may not be increased and all work completed in accordance with this catalog prior to the curriculum change will be applied toward the student's degree requirements. Courses that are modified or added to a curriculum and incorporated into the curriculum at a level beyond that at which a student is enrolled may become graduation requirements for that student. Courses that are incorporated into the curriculum at a level lower than the one at which the student is enrolled are not required for that student. Former students of the college who have been out of school for two consecutive semesters must meet the curriculum requirements in effect at the time of their readmission.

### **Graduation Requirements**

*A candidate for a degree in the Frank H. Dotterweich College of Engineering must satisfy the university's "General Education Requirements" as set forth earlier in the catalog.*

*A candidate for a degree from the Frank H. Dotterweich College of Engineering must also meet the following requirements in fulfilling one of the degree plans prescribed on the following pages.*

All candidates must satisfy the requirements to maintain a grade point average of 2.0 on (1) all course work attempted and (2) all course work attempted at A&M-Kingsville.

Candidates for engineering or computer science degrees must also maintain a grade point average of 2.0 in (1) all engineering and computer science courses in the major specified for the degree and (2) all mathematics and natural science courses specified for the degree.

Candidates for the industrial technology degree must also maintain a grade point average of 2.5 in (1) all course work specified for their major and (2) 2.0 for all business administration course work specified for the degree.

It is the candidate's responsibility to ensure that all degree requirements are met.

# WAYNE H. KING DEPARTMENT OF CHEMICAL ENGINEERING AND NATURAL GAS ENGINEERING

John Chisholm, *Interim Chair*

Engineering Complex 303. MSC 193. Extension 2002.

## *Professors*

Al-Saadoon, Heenan, Mills, Pilehvari, Serth

## *Associate Professors*

Chisholm, Duarte, Lee

## **The Educational Objectives of the Chemical Engineering Program are:**

- 1. To prepare students for achieving successful careers in the chemical process industries, related industries and governmental agencies.**
- 2. To prepare students for post-graduate study in chemical engineering or related disciplines.**
- 3. To instill in students a sense of leadership in and responsibility to their profession and to society in general.**

## **CHEMICAL ENGINEERING (CHEN)**

**1201. Engineering as a Career.** (ENGR 1201) 2(1-3)

Introduction to chemical engineering and its role in society. Chemical engineering skills, tools and techniques applied to problem solving and academic and professional survival strategies. Introduction to conservation principles, transport phenomena, design and ethics. Includes a writing component as well as use of computers (spreadsheets, tables, graphing and simulations). For students planning to pursue a career in chemical engineering.

**1301. Engineering as a Career.** 3(3-0)

Principles of student success in college. Chemical engineering as an academic and professional career. Conversion of problem data to a unified unit system for problem solving.

**2371. Conservation Principles.** 3(3-0)

Applications of the conservation laws of mass and energy to the solution of chemical engineering problems. Prerequisites: CHEM 1312 and CHEN 1301 or PHYS 2325/2125.

**3310. Heat Transfer Phenomena.** 3(3-0)

Fundamentals of energy transport and system applications involving this operation including computer applications to heat exchanger design. Prerequisites: CHEN 3392, CHEM 2421 or CHEM 3323/3123 and CHEN 3347 or MEEN 3347.

**3315. Chemical Process Design I.** 3(3-0)

Basic principles and techniques of economic analysis and cost engineering with applications to problems in chemical process and equipment design. Prerequisites: CHEN 2371 and credit for or registration in CHEN 3310.

**3321. Process Simulation.** 3(3-0)

The basic numerical methods used in chemical process simulation. An introduction to the use of commercial process simulators, with hands-on applications. Prerequisite: MATH 3320.

**3347. Chemical Engineering Thermodynamics I.** 3(3-0)

Theory and applications of the first and second laws of thermodynamics to mechanical, chemical, magnetic and electrical interactions for both reversible and irreversible processes. Prerequisite: MATH 2414. Corequisite: PHYS 2326/2126.

**3371. Chemical Engineering Thermodynamics II.** 3(3-0)

Procedures for deciding when and to what extent chemical reactions and phase changes may be expected to occur according to the basic principles of physical chemistry and the laws of thermodynamics. Application of computers to advanced thermodynamic problems. Prerequisites: CHEM 3331, CHEM 3325/3125 and CHEN 3347.

- 3392. Fluid Transport Phenomena.** 3(3-0)  
 Fundamentals of momentum transport, including fluid statics, flow of compressible and incompressible fluids, pumps, turbines and compressors, with computer applications. Prerequisite: MATH 3320 and credit or registration in MEEN 2355 or MEEN 2302.
- 4278. Unit Operations.** 2(0-6)  
 Selected laboratory experiments on fluid flow and heat transfer. Prerequisite: CHEN 3310.
- 4279. Unit Operations Laboratory.** 2(0-6)  
 Selected laboratory experiments in heat and mass transfer. Prerequisite: CHEN 4389.
- 4311. Biochemical Engineering.** 3(3-0)  
 Principles involved in the processing of biological materials using biological agents such as cells, enzymes or antibodies. Prerequisites: CHEM 3323/3123 or CHEM 2421 and CHEM 3331.
- 4316. Chemical Process Design II.** 3(3-0)  
 The application of chemical engineering principles to a sequence of design problems utilizing computer software, such as SIMSCI. Prerequisites: CHEN 3315, CHEN 3371 and CHEN 3310.
- 4317. Chemical Process Design III.** 3(3-0)  
 The application of chemical engineering principles, including economic criteria to a comprehensive design problem. Computer software is utilized as a design aid. Prerequisites: CHEN 4316, CHEN 4373, CHEN 4389 and credit for or registration in CHEN 4392.
- 4335. Special Problems.** V:1-3  
 Individual solution of selected problems in chemical engineering conducted under direct supervision of a faculty member. May be repeated for up to six hours. Prerequisite: senior standing.
- 4373. Kinetics and Reactor Design.** 3(3-0)  
 Chemical reaction rates and design of chemical reactors. Applications of computers to chemical kinetics and the design of chemical reactors. Prerequisites: CHEN 3371, CHEN 3310 and CHEM 3332.
- 4383. Natural Gas Processes.** 3(3-0)  
 The design, operation and economics of systems for the utilization of hydrocarbon gases and liquids, the concentration of their components by absorption and fractionalization procedures. Use of computer aided design and economic evaluation of facility designs. Prerequisite: CHEN 4389.
- 4386. Air Pollution Control.** 3(3-0)  
 A fundamental approach to air pollution testing, control and design of control systems. Introduction to dispersion modeling via computer. Prerequisite: CHEN 3392 and senior standing.
- 4389. Mass Transfer Phenomena.** 3(3-0)  
 Fundamentals of mass transport, including gas absorption, extraction, membrane separation, binary and multicomponent distillation, with computer design applications. Prerequisites: CHEM 3331 and credit or registration in CHEN 3310.
- 4392. Process Dynamics and Control.** 3(2-3)  
 Basic operating theory of control instruments and their application to industrial chemical process. Applications of computers to process control. Prerequisites: CHEN 4373 and CHEN 4389.
- 4399. Internship in CHEN.** V: 1-3  
 Internships in industry, government or consulting companies in career-based practical activities to broaden the skills obtained through curricular education. Prerequisite: junior standing.

**Degree Requirements**  
**Bachelor of Science in Chemical Engineering**

Accredited by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD  
 21202-4012 - telephone: (410) 347-7700

<b>Freshman Year</b>				<b>Junior Year</b>			
CHEM 1311/1111	4	CHEM 1312/1112	4	CHEM 3331	3	CEEN 3317	3
CHEN 1301	3	ENGL 1302	3	CHEN 3347	3	CHEN 3310	3
CSEN 2303	3	HIST 1301	3	CHEN 3392	3	CHEN 3321	3
ENGL 1301	3	MATH 2414	4	POLS 2302	3	CHEN 3371	3
MATH 2413	4	PHYS 2325/2125	4	*Communications	3	EVEN 2372	3
	17		18	Elective			15
				POLS 2340	3		
					18		
<b>Sophomore Year</b>				<b>Senior Year</b>			
CHEM 3323/3123	4	CHEM 3325/3125	4	BIOL 1306	3	CHEN 4279	2
CHEN 2371	3	MEEN 2355	3	CHEN 4278	2	CHEN 4311	3
HIST 1302	3	PHYS 2326/2126	4	CHEN 4316	3	CHEN 4317	3
MATH 3320	3	POLS 2301	3	CHEN 4373	3	CHEN 4392	3
*Humanities B. Elective	3	*Fine Arts Elective	3	CHEN 4389	3	MATH 3415	4
	16		17		14		15

**Total Hours Reqd: 130**

Electives are selected from the following:

Fine Arts Electives: ARTS 1303, ARTS 1304, MUSI 2308, MUSI 2310.

Communications Elective - BCOM 2304, ENGL 2374 or COMS 2374.

Humanities B. Elective - Any 2000 level course satisfying the General Education Requirement.

*^For courses listed under Core Curriculum "Components" see "General Requirements for Graduation with a Baccalaureate Degree" in an earlier section of this Catalog.*

# DEPARTMENT OF CIVIL AND ARCHITECTURAL ENGINEERING

Joseph Sai, *Chair*

Engineering Complex 376. MSC 194. Extension 2267.

## *Professors*

Faruqi, Leelani, Sai

## *Assistant Professors*

Aguiniga, Bailey, Caeiro, Sun, Wang

## *Lecturer*

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### **The Educational Objectives of the Civil Engineering Program are:**

1. To instill in our students a sense of the scholarship and leadership of the civil engineering profession.
2. To educate and prepare students for a lifelong career as practicing professional civil engineers who are ethical and socially responsible.
3. To produce graduates with a strong academic base for advanced studies.

### **The Educational Objectives of the Architectural Engineering Program are:**

1. To provide graduates with the necessary engineering skills to engage in lifelong careers as practicing professional architectural engineers who are ethical and socially responsible.
2. To develop engineering graduates with a broad understanding of the problem-solving and design skills necessary to operate in the interdisciplinary arena of architectural engineering.
3. To provide candidates with the knowledge and skills of mathematics, science and engineering necessary to pursue post-baccalaureate studies.

## **ARCHITECTURAL ENGINEERING (AEEN)**

### **1310. Computer Graphics and Applications.**

3(2-3)

Introduction to procedures in computer-aided drafting and computer applications with a programming language element. Required of all freshmen in Civil and Architectural Engineering.

### **1320. Introduction to Architectural Design.**

3(1-6)

Introduction to architectural design principles, concepts and problem-solving approaches. Issues addressed by a series of two- and three-dimensional building studies. Six laboratory hours a week. Prerequisite: AEEN 2325.

### **2325. Introduction to Development in Architecture.**

3(3-0)

Principles of architectural development with emphasis on form and space relationships, structural elements, building materials and methods of construction, building and site relationships. Prerequisite: AEEN 1310.

### **3303. Structural Analysis.**

3(3-0)

Statically determinate structures. Moving loads. Analysis of statically indeterminate structures by consistent deformation, slope-deflection and moment-distribution. Prerequisite: CEEN 3311. Credit may not be obtained in both AEEN 3303 and CEEN 3303.

### **3304. Reinforced Concrete Design.**

3(3-0)

Mechanics, behavior and design of reinforced concrete members subject to axial loads, bending, torsion and shear. Prerequisite: AEEN 3303. Credit may not be obtained in both AEEN 3304 and CEEN 3304.

### **3325. Design Codes and Ordinances.**

3(3-0)

Design codes and municipal ordinances and their integration in design. Including zoning occupancy, construction classification, building constraints, fire resistant construction, egress, accessibility and plumbing. Prerequisite: AEEN 2325.

**3331. Building Construction.** 3(3-0)  
Discussion of properties of construction materials and components; fabrication and construction technologies, methods and processes; engineered systems characteristic of commercial buildings such as foundation, structural, building envelope, mechanical and electrical systems. Credit may not be obtained in both AEEN 3331 and ITEN 3331.

**3335. Environmental Systems for Buildings.** 3(3-0)  
Planning and design of lighting and climate control systems including heating, ventilation and air conditioning. Introduction to plumbing systems including water and wastewater piping systems. Prerequisite: MEEN 3347 and Corequisite: CEEN 3392.

**4279. Senior Design Project I.** 2(1-3)  
Application of engineering concepts covered in the upper division courses to architectural engineering problems including design of building structural and services systems, with emphasis on teamwork. Introduction to practical aspects of construction and professional ethics. Prerequisites: AEEN 3304 and CEEN 3342.

**4289. Senior Design Project II.** 2(1-3)  
Application of engineering concepts covered in the upper division courses to architectural engineering problems including design of building structural and services systems, with emphasis on teamwork. Introduction to practical aspects of construction and professional ethics. Prerequisites: AEEN 4316 and AEEN 4320.

**4310. 3D Computer Modeling.** 3(2-3)  
Introduction to three-dimensional computer modeling. Includes 3D wire frame construction in AutoCAD, extrusion and Boolean for AutoCAD and Viz, basic application of skins, lighting and rendering techniques. Prerequisite: AEEN 1310.

**4316. Structural Steel Design.** 3(3-0)  
AISC specifications for the design of axially loaded members, beams, columns and connections. Introduction to plastic design. Prerequisite: AEEN 3303. Credit may not be obtained in both AEEN 4316 and CEEN 4316.

**4320. Building Services Engineering.** 3(3-0)  
Planning and design of heating, ventilation, air-conditioning, plumbing, power distribution and lighting systems; introduction to fire protection systems. Prerequisite: AEEN 3335 and EEEN 3331.

**4326. Construction Engineering.** 3(3-0)  
Construction methods and management of earthwork with heavy equipment and others. Construction estimating, planning and control. Network theory and critical path methods. Prerequisite: AEEN 3303 and Corequisite: CEEN 3317. Credit may not be obtained in both AEEN 4326 and CEEN 4326.

**4333. Real Design and Construction.** 3(2-3)  
Real-world design/build course with projects emphasizing development of design, implementation of best practice construction, field experience and government work. Prerequisites: AEEN 1320, AEEN 2325.

**4336. Selected Topics.** V:1-3  
One or more topics of architectural engineering. May be repeated when topic changes. Prerequisite: senior standing.

## **CIVIL ENGINEERING (CEEN)**

**1201. Civil Engineering as a Career.** (ENGR 1201) 2(1-3)  
Orientation course covering the history of engineering, its disciplines and professional practice with emphasis on social responsibility and ethical behavior. Introduces students to the profession of civil and architectural engineering; provides basic skills, tools and techniques applied to problem solving, teamwork and communication necessary for academic and professional success. A laboratory component will stimulate the student's interest in engineering. Required of all entering civil and architectural engineering freshmen and transfer students with fewer than 16 hours.

**2113. Surveying Laboratory.** 1(0-3)  
Engineering field surveying and practices of taping, leveling, traversing, error adjustments, stadia, earthwork and highway curves. Corequisite: CEEN 2212.

- 2212. Surveying.** 2(2-0)  
Engineering principles and practices of plane surveying, taping, leveling, traversing, surveying errors, topographic stadia, earthwork, highway curves and construction surveys. Prerequisite: MEEN 1310. Corequisite: MATH 2413.
- 2301. Mechanics I.** (ENGR 2301) 3(3-0)  
Resultants of force systems. Statics of beams, trusses, frames and other engineering structures. Friction. Distributed forces. Centroids and centers of gravity. Moments of inertia of areas and masses, Mohr's circle. Prerequisite: PHYS 2325/2125. Corequisite: MATH 2414.
- 3143. Geotechnical Engineering Laboratory.** 1(0-3)  
Principles and practices of geotechnical engineering laboratory with emphasis on the related ASTM and AASHTO testing standards. Corequisite: CEEN 3342.
- 3144. Construction Materials.** 1(1-0)  
Engineering properties of materials for design and construction. Related ASTM test specifications of construction materials such as concrete, asphalt, timber, steel, synthetic materials, etc. Prerequisites: CEEN 3311.
- 3145. Construction Materials Laboratory.** 1(0-3)  
Engineering principles and practices for testing construction materials based on ASTM testing standards. Corequisite: CEEN 3144.
- 3167. Hydraulics and Environmental Engineering Laboratory.** 1(0-3)  
Open-channel-flow visualization and measurement, hydraulic machinery characteristics and water and wastewater analysis. Corequisite: CEEN 3365.
- 3303. Structural Analysis.** 3(3-0)  
Statically determinate structures. Moving loads. Analysis of statically indeterminate structures by consistent deformation, slope-deflection and moment-distribution. Prerequisite: CEEN 3311.
- 3304. Reinforced Concrete Design.** 3(2-3)  
Mechanics, behavior and design of reinforced concrete members subject to axial loads, bending, torsion and shear. Prerequisite: CEEN 3303.
- 3311. Strength of Materials.** 3(3-0)  
Hooke's Law; stress and strain at a point; Mohr's circle; axial stresses; torsion; shear, moment and deflection in beams; shear center; unsymmetrical bending; columns; theories of failure; introduction to fatigue; and statically indeterminate members. Prerequisites: CEEN 2301 and MATH 2414.
- 3317. Engineering Economy.** 3(3-0)  
Principles of economic analysis applied to engineering; evaluation of engineering alternatives; economic significance of engineering proposals. Cash flow diagrams, equivalence of cash flow patterns, interest, rate of return comparison, inflation, time value of money, income tax and depreciation, benefit/cost comparison, break even analysis, fixed costs, operating costs and other costs. Prerequisite: junior standing in engineering.
- 3342. Geotechnical Engineering.** 3(3-0)  
Principles of geotechnical engineering, soil composition, classification, flownet, compaction, consolidation, effective stress, bearing capacity and slope stability. Prerequisites: CEEN 3311 and PHYS 2326/2126.
- 3365. Environmental Engineering.** 3(3-0)  
Treatment and distribution of water. Wastewater conveyance and treatment systems. Physical, chemical and biological treatment processes. Solid waste management. Introduction to air pollution control. Prerequisites: CEEN 3392 and CHEM 1311/1111. Corequisite: CEEN 3167.
- 3392. Hydraulics and Fluid Mechanics.** 3(3-0)  
Fluid statics, flow of fluids through pipes and open channels, hydraulic machines. Prerequisite: MEEN 2302.

*In addition to the listed prerequisite for the following 4000 series courses, a student must have an overall grade point average of 2.0 or higher.*

- 4279. Design in Civil Engineering I.** 2(1-3)  
Engineering concepts integrated from the topics taught in sequences of upper division courses to produce practical, efficient and feasible solutions of civil engineering problems. Computer applications are included. Prerequisites: CEEN 3303 and a minimum GPA of 2.0 in mathematics and science. Corequisite: CEEN 4362.
- 4289. Design in Civil Engineering II.** 2(1-3)  
Engineering concepts integrated from the topics taught in sequences of upper division courses to produce practical, efficient and feasible solutions of civil engineering problems. Computer applications are included. Prerequisites: CEEN 3342, CEEN 4316 and a minimum GPA of 2.0 in mathematics and science.
- 4314. Matrix Methods in Structural Analysis.** 3(3-0)  
Formulation and application of the direct stiffness method to truss, beam and frame structures; introduction to the finite element method for 2-D problems; and use and interpretation of computer structural analysis programs. Prerequisite: CEEN 3303.
- 4316. Structural Steel Design.** 3(3-0)  
AISC specifications for the design of axially loaded members, beams, columns and connections. Introduction to plastic design. Prerequisite: CEEN 3303.
- 4317. Computer Methods in Civil Engineering.** 3(2-3)  
Application of computer methods to solution of civil engineering problems, including the use of mathematical modeling, error analysis, optimization, solution of algebraic and differential equations and integration pertaining to infrastructure system analysis. Prerequisite: CEEN 4316.
- 4320. Foundation Engineering Analysis.** 3(3-0)  
Bearing capacity and related soil properties for analysis and design of foundations, including retaining walls. Prerequisites: CEEN 3303 and CEEN 3342.
- 4326. Construction Engineering.** 3(3-0)  
Construction methods and management of earthwork with heavy equipment and others. Construction estimating, planning and control. Network theory and critical path methods. Prerequisite: credit or registration in CEEN 3342 and CEEN 3317.
- 4336. Selected Topics.** V:1-3  
One or more topics of civil engineering. May be repeated when topic changes. Prerequisite: senior standing.
- 4359. Principles of Transportation Engineering.** 3(2-3)  
Principles of transportation engineering, profession of transportation engineering, system and organization, system characteristics, traffic engineering studies, traffic flow, intersection control and capacity, highway alignment and capacity. Prerequisite: senior standing in engineering.
- 4362. Hydrology.** 3(3-0)  
Hydrologic cycle; transpiration, evaporation, snow melt and planetary circulation. Rainfall-runoff relations, index, unit hydrographs, synthesized hydrographs. Binomial, normal and extreme-value skewed distributions. Prerequisites: CEEN 3392. Corequisite: STAT 4303.
- 4364. Design of Water and Wastewater Conveyance Systems.** 3(3-0)  
Water and wastewater flows and measurement, design of water transportation systems, design of gravity-flow sanitary sewers and stormwater drainage systems, pumps and pump systems, design of pumping stations. Prerequisite: CEEN 3392.
- 4367. Introduction to Geoenvironmental Engineering.** 3(3-0)  
Soil-water-contaminant interaction processes, conduction phenomena, hydraulic conductivity and contaminant transport phenomena, effects of contaminants on soil properties, site characterization and soil remediation techniques; design aspects of waste containment systems such as landfills, seepage barriers and cutoff walls. Prerequisites: CEEN 3342 and CEEN 3365.

**4368. Foundation Engineering.**

3(3-0)

Soil strength. Bearing capacity of soils and shallow foundation. Immediate and consolidation settlement. Lateral earth pressure theory and retaining walls. Deep foundation and stability analysis of soil slopes. Prerequisite: CEEN 3342.

**4369. Transportation Engineering Design.**

3(2-3)

Engineering design concepts used to produce practical, efficient, economical and feasible solutions to problems in such transportation areas as highways, traffic freight and materials movement, railroads and air transport. Computer applications are included. Prerequisites: CSEN 2304 and CEEN 3311.

**4489. Design in Civil Engineering II.**

4(2-6)

Engineering concepts integrated from the topics taught in sequences of upper division courses to produce practical, efficient and feasible solutions of civil engineering problems. Computer applications are included. Prerequisites: CEEN 3342 and CEEN 4316.

**Degree Requirements**  
**Bachelor of Science in Architectural Engineering**

<b>Freshman Year</b>				<b>Junior Year</b>			
AEEN 1310	3	AEEN 2325	3	AEEN 3303	3	AEEN 3304	3
CEEN 1201	2	ENGL 1302	3	AEEN 3331	3	AEEN 3335	3
CHEM 1311/1111	4	HIST 1301	3	BCOM 2304,	3	POLS 2302	3
ENGL 1301	3	MATH 2414	4	COMS 2374 or		<i>^Literature/philosophy</i>	3
MATH 2413	4	PHYS 2325/2125	4	ENGL 2374		<i>^Social/behavioral</i>	3
	16		17	CEEN 3143	1		15
				CEEN 3342	3		
				CEEN 3392	3		
					16		
<b>Sophomore Year</b>				<b>Senior Year</b>			
CEEN 2301	3	AEEN 1320	3	AEEN 4279	2	AEEN 4289	2
HIST 1302	3	CEEN 3311	3	AEEN 4316	3	AEEN 4326	3
PHYS 2326/2126	4	MATH 3320	3	AEEN 4320	3	CEEN 3144	1
<i>^Global learning</i>	3	MEEN 3347	3	CEEN 3317	3	CEEN 3145	1
Math or Science Elective	3	POLS 2301	3	STAT 4303	3	EEEN 3331	3
	16	<i>^Visual/performing arts</i>	3	Engineering Elective	3	Engineering Elective	3
			18		17	Math or Science Elective	3
							16

Total Hours Req'd: 131

Engineering electives: CEEN 2113, CEEN 2212, CEEN 4314, CEEN 4320, CEEN 4364, CEEN 4368; ITEN 2330, ITEN 3313, ITEN 4353, MEEN 3348, MEEN 3349 or any engineering course approved by the department chair and academic adviser.

Mathematics and science electives: CHEM 1312/1112 or any advanced chemistry course approved by the department chair and academic adviser, MATH 3315, MATH 4341, MATH 4372 or MATH 4374, BIOL 1306/1106, BIOL 2421, GEOG 2472, GEOL 3305, GEOL 3407, GEOG 3450, GEOG 4435, GEOL 4425, or any other course in mathematics or science approved by the department chair and academic adviser.

**Degree Requirements**  
**Bachelor of Science in Civil Engineering**

Accredited by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012 - telephone: (410) 347-7700

<b>Freshman Year</b>				<b>Junior Year</b>			
AEEN 1310	3	ENGL 1302	3	CEEN 3143	1	CEEN 3144	1
CEEN 1201	2	HIST 1301	3	CEEN 3303	3	CEEN 3145	1
CHEM 1311/1111	4	MATH 2414	4	CEEN 3342	3	CEEN 3167	1
ENGL 1301	3	PHYS 2325/2125	4	CEEN 3392	3	CEEN 3304	3
MATH 2413	4	Fine Arts Elective	3	STAT 4303	3	CEEN 3365	3
	16		17	<i>^Global learning</i>	3	MEEN 3347	3
					16	POLS 2301	3
						<i>^Social/behavioral</i>	3
							18
<b>Sophomore Year</b>				<b>Senior Year</b>			
CEEN 2113	1	BCOM 2304/	3	CEEN 3317	3	CEEN 4289	2
CEEN 2212	2	COMS 2374/		CEEN 4279	2	CEEN 4359	3
CEEN 2301	3	ENGL 2374		CEEN 4316	3	EEEN 3331	3
HIST 1302	3	CEEN 3311	3	CEEN 4362	3	Engineering Elective	3
PHYS 2326/2126	4	MATH 3320	3	Engineering Elective	3	Engineering Elective	3
MATH + Science Elect.	3	MEEN 2302	3	MATH + Science Elect.	3		14
	16	POLS 2302	3		17		
		Humanities B. Elective	3				
			18				

Total Hours Req: 132

Engineering electives: CEEN 4314, CEEN 4320, CEEN 4317, CEEN 4326, CEEN 4336, CEEN 4364, CEEN 4367, CEEN 4368, CEEN 4369; EVEN 4317, EVEN 4357, MEEN 3145, MEEN 3344.

Mathematics and science electives:

Recommended: GEOL 1303, GEOL 3305 or GEOL 4425

CHEM 1312/1112 or any approved upper-level chemistry course

MATH 3415, MATH 4341, MATH 4372, MATH 4374

BIOL 1306, BIOL 2421, GEOG 2472, GEOG 3450, GEOG 4435, GEOL 3407 or any other approved upper-level course in mathematics or science.

Fine arts electives: ARTS 1303, ARTS 1304; MUSI 2308, MUSI 2310.

*^For courses listed under Core Curriculum "Components" see "General Requirements for Graduation with a Baccalaureate Degree" in an earlier section of this Catalog.*

# DEPARTMENT OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

Sung-won Park, *Chair*

Engineering Complex 303. MSC 192. Extension 2004.

## *Professors*

Challoo, Nekovei, Omar, Park

## *Associate Professors*

Leung, McLauchlan

## *Assistant Professors*

Hao, Montiel, Varvel, Verma, Yilmaz, Yilmazer

## *Lecturer*

Yang

## *Faculty Emeritus*

Gorakhpurwalla

### **The Educational Objectives of the Electrical Engineering Program are:**

- 1. To prepare graduates for careers as engineering professionals and/or for graduate studies.**
- 2. To enable graduates to pursue state-of-the-art solutions to engineering problems and to evaluate and embrace new technologies.**
- 3. To instill in graduates personal commitment to high ethical standards, sound business decisions and engineering excellence.**

## **COMPUTER SCIENCE (CSEN)**

### **2303. Introduction to Computing Using Visual Basic and Excel.**

3(3-0)

Problem solving methods and algorithm development. Computer programming using Visual Basic. How to use Excel. Designing, coding, debugging and documenting programs using techniques of good programming style. Prerequisites: MATH 1314 and MATH 1316 or equivalent.

### **2304. Introduction to Computer Science. (ENGR 2304)**

3(3-0)

Introduction to computer systems, problem solving methods and algorithm development. Structured programming using a programming language such as C. Designing, coding, debugging and documenting programs using techniques of software development cycle. Prerequisites: MATH 1314 and MATH 1316 or equivalent.

### **2310. Object-Oriented Software Engineering.**

3(3-0)

Introduction to objects, object-oriented analysis and modeling, object-oriented design, implementation using an object-oriented language, such as C++. Prerequisite: CSEN 2328.

### **2328. Data Structures.**

3(3-0)

Algorithm analysis, lists, stacks, queues, trees, hashing, priority queues, sorting, graph algorithms and algorithm design. Prerequisite: CSEN 2304.

### **2330. Assembly Language and Computer Organization.**

3(3-0)

Basic concepts of computer systems and computer architecture. Machine instructions and basic data types. Representation of information. Arithmetic and logical operations. Addressing operands in storage. Assembly language programming. Prerequisite: CSEN 2304.

*In addition to the listed prerequisite for the following 4000 series courses, a student must have an overall grade point average of 2.0 or higher.*

### **4201-4202. Senior Project.**

4(1-3)

A major project of an original nature carried to completion over a period of two semesters. Normally taken in the final academic year prior to graduation. Prerequisite: senior standing in Computer Science.

**4314. Database Management Systems.** 3(3-0)  
File and database organization techniques. Network, hierarchical and relational data models. Normalization. Commercially-available DBMS. Query languages. DBMS design and implementation.

**4316. Software Engineering I.** 3(3-0)  
Introduction to formal software design principles. An engineering approach to software development. Software project management. Software requirements analysis, specification, design, development and validation. Prerequisite: 6 semester hours of Computer Science or Computer Information Systems.

**4317. Software Engineering II.** 3(3-0)  
Advanced software design principles. An engineering approach to software development emphasizing advanced techniques for validation and verification. Prerequisite: CSEN 4316.

**4320. Computer Networks.** 3(3-0)  
Data communication networks and ISO reference model, the electrical interface, data transmission, data link and its protocols, local area network and its protocols, wide area network and its protocols, internetworking. Prerequisite: 6 hours of upper level Computer Science.

**4335. Selected Topics.** V:1-3  
One or more topics of computer science. May be repeated for a total of 6 semester hours. Prerequisite: consent of instructor.

**4336. Special Problems.** V:1-3  
Individual solution of selected problems in computer science conducted under direct supervision of a faculty member. May be repeated for up to 6 semester hours. Prerequisite: consent of instructor.

**4361. System Software.** 3(3-0)  
The study of system software components such as assemblers, macros and macro processors, compilers, linkers and loaders. The function and development of these components are emphasized. Prerequisite: CSEN 2330 or EEEN 3449.

**4362. Operating Systems.** 3(3-0)  
Study of operating system principles, including process management, memory management, resource allocation and input, output and interrupt processing. Prerequisite: CSEN 2330 or EEEN 3449.

**4366. Theory of Programming Languages.** 3(3-0)  
Formal definition of programming languages including specification of syntax and semantics. Precedence, infix, prefix and postfix notation. Global properties of algorithmic languages. List processing, string manipulation, data description and simulation languages. Run-time representation of program and data structures. Prerequisite: CSEN 2328.

## **ELECTRICAL ENGINEERING (EEEN)**

**1201. Introduction to Electrical Engineering.** (ENGR 1201) 2(1-3)  
Introduction to electrical engineering and its role in society. Electrical engineering skills, tools and techniques applied to problem solving and academic and professional survival strategies. Introduction to electrical circuits, electrical measurements, digital logic and ethics. Includes a writing component as well as use of computers (spreadsheets, tables, graphing and simulations). For students planning to pursue a career in electrical engineering or computer science.

**2323. Network Analysis I.** 3(3-0)  
Introduction to linear network analysis techniques. Phasor analysis and sinusoidal steady-state response. Single-phase and polyphase circuits. Prerequisites: MATH 2414; Corequisites: PHYS 2326/PHYS 2126 and MATH 3320.

**2340. Digital Logic Design.** 3(3-0)  
Hardware implementation of arithmetic and logical functions, organization and design of digital systems. Prerequisites: CSEN 2304.

**3112. Electronic Devices and Circuits Laboratory I.** 1(0-3)  
Laboratory course to correlate with the basic theory presented in sophomore and first semester junior courses. Prerequisite: credit for or registration in EEEN 3325.

- 3212. Circuits and Electronics Lab.** 2(1-3)  
Laboratory course to correlate with circuits and electronics. Prerequisite: credit for or registration in EEEN 3325.
- 3321. Network Analysis II.** 3(3-0)  
Two-port networks, Fourier analysis, time domain response, transient response and Laplace transform techniques. Prerequisites: EEEN 2323, CSEN 2304 and MATH 3320.
- 3324. Electromagnetics.** 3(3-0)  
Vector analysis, electrostatics, steady magnetic fields. Maxwell's equations, uniform plane waves, circuit concepts, propagation and radiation. Prerequisites: PHYS 2326/PHYS 2126 and MATH 3320.
- 3325. Electronics I.** 3(3-0)  
Solid state fundamentals. Nonlinear devices and networks. Fabrication of integrated circuits. Two-port models. Prerequisites: EEEN 2323 and PHYS 2326/PHYS 2126.
- 3331. Circuits and Electromagnetic Devices.** 3(3-0)  
General network analysis, steady-state AC/DC circuits. Energy conversion and applications. Prerequisite: PHYS 2326/2126.
- 3333. Linear Systems and Signals.** 3(3-0)  
Signal representation, sampling and quantization, Laplace and z-transforms, transfer functions and frequency response, convolution, stability, Fourier series, Fourier transforms and applications. Prerequisite: EEEN 3321.
- 3334. Random Signals.** 3(3-0)  
Probability, random variables, white noise and band-limited system, narrowband Gaussian process, pseudorandom signals and random signal response of linear systems. Prerequisite: MATH 2414.
- 3424. Principles and Applications of Engineering Electromagnetics.** 4(3-3)  
Vector analysis, electrostatics, steady magnetic fields. Maxwell's equations, uniform plane waves, circuit concepts, propagation and radiation. Prerequisites: PHYS 2326/2126 and MATH 3320.
- 3449. Microprocessor Systems.** 4(3-3)  
Basic computer structure, the instruction set, addressing modes, assembly language programming, assembly language subroutines, arithmetic operations, programming in C, implementation of C procedures, elementary data structures, input and output and a survey of microprocessor design. Prerequisites: EEEN 2340.
- In addition to the listed prerequisite for the following 4000 series courses, a student must have an overall grade point average of 2 or higher.*
- 4124. Electrical Engineering Projects Laboratory.** 1(0-3)  
Participation in engineering design activity. Prerequisite: EEEN 4152.
- 4152. Advanced Electronics Laboratory.** 1(0-3)  
Analysis and design of electronic circuits and systems. Prerequisite: EEEN 3113.
- 4224. Electrical and Computer Engineering Projects Laboratory.** 2(0-6)  
Participation in engineering design activity. Prerequisite: EEEN 4252.
- 4252. Advanced Laboratory.** 2(1-3)  
Analysis and design of electrical, electronic and digital systems. Prerequisites: EEEN 3312, EEEN 3333, EEEN 3449 and communication elective.
- 4310. Introduction to VLSI Circuit Design.** 3(3-0)  
Introduction to design and fabrication of micro-electronic circuits via Very Large Scale Integrated (VLSI) circuitry; structured design methods for VLSI systems, use of computer-aided design (CAD) tools and design projects of small to medium scale integrated circuits. Prerequisites: EEEN 3325 and EEEN 2340.

- 4329. Communications Engineering.** 3(3-0)  
Transmission of information. Probability, stochastic process and spectral analysis. Sampling, quantization, decision theory, coding and decoding. Digital communication system and secure communications. Introduction to DSP. Prerequisites: EEEN 3333 and EEEN 3334.
- 4335. Special Problems.** V:1-3  
Individual solution of selected problems in electrical engineering conducted under direct supervision of a faculty member. May be repeated for up to 6 hours. Prerequisite: consent of instructor.
- 4336. Selected Topics.** V:1-3  
One or more topics of electrical engineering. May be repeated when topic changes. Prerequisite: consent of instructor.
- 4340. Power Electronics.** 3(2-3)  
Classical and modern design and analysis methods of power electronic circuits and the feedback control designs of power electronic converters and related laboratory experiments. Topics include diode rectifiers, thyristor converters, DC-DC converters and associated controls, DC/AC inverters, power-factor correction and control, isolated switch-mode power supplies, applications of power electronic converters and related hardware and virtual laboratory experiments. Prerequisite: EEEN 3325 or consent of instructor.
- 4342. Electronics II.** 3(3-0)  
Analysis and design of analog electronic circuits; differential, multistage and power amplifiers; frequency response; feedback and stability. Prerequisite: EEEN 3325.
- 4343. Microprocessor-based Control Systems.** 3(3-0)  
Design of microprocessor-based real-time control systems. Application of theoretical principles in electrical engineering to control small-scale systems, such as a mobile robot incorporating sensors, actuators and intelligence. Controller design; signal conditioning and drive circuits for interfacing with various sensors and actuators; programming and programmable logic controllers. Prerequisites: EEEN 3333 and EEEN 3449.
- 4344. Computer Architecture and Design.** 3(3-0)  
Basic computer organization, data representation and arithmetic, instruction sets and addressing modes, assembly language, data path and control, memory, input and output and communication. Prerequisites: EEEN 3449 or CSEN 2330, EEEN 2340.
- 4354. Linear Control Systems.** 3(3-0)  
Analysis and design techniques for linear feedback control systems. Controller functions and compensation, applications to serve and process control problems. Prerequisite: EEEN 3333.
- 4355. Digital Systems Engineering.** 3(2-3)  
Principles in digital system design and testing, digital integrated circuits, digital system design with PLDS and FPGAS, introduction to an HDL, memory, microprocessors and design for testability. Prerequisites: EEEN 3325 and EEEN 2340.
- 4422. Electric Drives.** 4(3-3)  
Introduction to power electronic converters for motor drives and controls, single and three phase transformers, DC motors and generators, feedback control design of DC motor drives, PMAC drives, synchronous generators, induction motor drives, speed and vector control of induction motor drives. Laboratory experiments to identify electric machine parameters and characteristics, and DC/AC motor drive controls, by designing and conducting experiments using digital computers. Prerequisite: EEEN 3321.

## Degree Requirements Bachelor of Science in Computer Science

Freshman Year				Junior Year			
CHEM 1311/1111	4	CSEN 2328	3	EEEN 3334	3	CSEN 4314	3
CSEN 2304	3	ENGL 1302	3	MATH 3370	3	CSEN 4316	3
EEEN 1201	2	HIST 1301	3	<sup>^</sup> Oral communication*	3	EEEN 3449	4
ENGL 1301	3	MATH 2414	4	<sup>^</sup> Social/behavioral	3	<sup>^</sup> Global learning**	<u>3</u>
MATH 2413	<u>4</u>	PHYS 2325/2125	<u>4</u>	***Approved Elective	<u>3</u>		13
	<u>16</u>		17		15		
Sophomore Year				Senior Year			
EEEN 2340	3	CSEN 2310	3	CSEN 4201	2	CSEN 4202	2
HIST 1302	3	EEEN 2323	3	CSEN 4317	3	CSEN 4320	3
MATH 3320	3	POLS 2302	3	CSEN 4361	3	CSEN 4362	3
PHYS 2326/2126	4	<sup>^</sup> Literature/philosophy	3	EEEN 4344	3	CSEN 4366	3
POLS 2301	<u>3</u>	<sup>^</sup> Visual/performing arts	<u>3</u>	***Approved Elective	<u>3</u>	***Approved Elective	<u>3</u>
	<u>16</u>		15		14		14
						Total Hours Req'd:	120

\* BCOM 2304, COMS 2374 or ENGL 2374 is strongly recommended.

\*\*EVEN 2372 is strongly recommended.

\*\*\*The approved electives must be selected with the consent of the student's adviser, and would normally be more advanced courses in computer science, computer information systems, mathematics, statistics or one of the sciences taken in the freshman and sophomore years. However, a meaningful sequence of courses in any discipline, such as engineering or agriculture, may be taken with the consent of the student's adviser, except that all such courses must be at the 2000-level or above.

## Degree Requirements Bachelor of Science in Electrical Engineering

Accredited by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD  
21202-4012 - telephone: (410) 347-7700

Freshman Year					
CHEM 1311/1111	4	EEEN 2340	3		
CSEN 2304	3	ENGL 1302	3		
EEEN 1201	2	HIST 1301	3		
ENGL 1301	3	MATH 2414	4		
MATH 2413	<u>4</u>	PHYS 2325/2125	<u>4</u>		
	16		17		
Sophomore Year					
EEEN 3449	4	EEEN 2323	3		
HIST 1302	3	POLS 2302	3		
MATH 3320	3	<sup>^</sup> Literature/philosophy	3		
PHYS 2326/2126	4	<sup>^</sup> Oral communication*	3		
POLS 2301	<u>3</u>	<sup>^</sup> Visual/performing arts	<u>3</u>		
	17		15		

\*BCOM 2304, ENGL 2374 or COMS 2374 is strongly recommended.

<sup>^</sup>For courses listed under Core Curriculum "Components" see "General Requirements for Graduation with a Baccalaureate Degree" in an earlier section of this Catalog.

**Junior and Senior Year**

Electrical engineering majors may choose either of the options listed for their junior and senior year courses. However for either choice a student must complete all requirements of one of the listed options.

**Computer Engineering Emphasis**

<b>Junior Year</b>			
EEEN 3321	3	CSEN 2328	3
EEEN 3325	3	EEEN 3212	2
EEEN 3334	3	EEEN 3333	3
MATH 3415	4	EEEN 4355	3
<sup>^</sup> Global learning*	<u>3</u>	MATH 3370	3
	16	<sup>^</sup> Social/behavioral	<u>3</u>
			17
<b>Senior Year</b>			
CEEN 3317	3	CSEN 4362	3
EEEN 4252	2	EEEN 4224	2
EEEN 4310	3	EEEN 4329	3
EEEN 4344	3	EEEN 4343	3
**Approved Elective	3	**Approved Elective	<u>3</u>
**Approved Elective	<u>3</u>		14
	17		
			<b>Total Hours Reqd: 129</b>

**Electrical Systems Emphasis**

<b>Junior Year</b>			
EEEN 3321	3	EEEN 3212	2
EEEN 3325	3	EEEN 3324	3
EEEN 3334	3	EEEN 3333	3
MATH 3415	4	EEEN 4355	3
<sup>^</sup> Global learning*	<u>3</u>	MATH 4341	3
	16	<sup>^</sup> Social/behavioral	<u>3</u>
			17
<b>Senior Year</b>			
CEEN 3317	3	EEEN 4224	2
EEEN 4252	2	EEEN 4329	3
EEEN 4342	3	MEEN 3347 or CHEN 3347	3
EEEN 4354	3	**Approved Elective	3
EEEN 4422	4	**Approved Elective	<u>3</u>
**Approved Elective	<u>3</u>		14
	18		
			<b>Total Hours Reqd: 130</b>

\*EVEN 2372 is strongly recommended.

\*\*Approved electives must be chosen as a sequence of courses to satisfy a professional objective and must be chosen with the consent of the department chair (MEEN 2355 is one of possible electives).

<sup>^</sup>For courses listed under Core Curriculum "Components" see "General Requirements for Graduation with a Baccalaureate Degree" in an earlier section of this Catalog.

## DEPARTMENT OF ENVIRONMENTAL ENGINEERING

Kim Jones, *Chair*

Engineering Complex 376. MSC 213. Extension 3046.

*Professor*

Jones

*Associate Professors*

Clapp, Martinez, Ren, Uddameri

*Assistant Professors*

Ramirez, Zhu

**The Educational Objectives of the Environmental Engineering Program are:**

- 1. Provide students with a broad engineering curriculum covering engineering fundamentals and major subject areas including water resources, air pollution, geo-environmental engineering, and sustainability and green engineering.**
- 2. Introduce students to interdisciplinary approaches to help them obtain the skills necessary to analyze, design and manage air, water, and solid and hazardous waste systems.**
- 3. Incorporate cutting-edge environmental research into the undergraduate environmental engineering curriculum to promote effective learning experiences.**
- 4. Provide student training in sustainable development principles at the regional, national and international scales by incorporating new technologies, engineering science and emerging environmental issues.**
- 5. Enhance student learning by providing students with the opportunity to participate in professional conferences and a variety of other educational media, such as study abroad programs and student engagement activities.**

### ENVIRONMENTAL ENGINEERING (EVEN)

#### **1201. Environmental Engineering as a Career.**

2(2-0)

Definition and role of the engineering in society. Engineering skills, tools and techniques applied to problem solving, academic and professional survival strategies.

#### **2310. Introduction to Environmental Engineering.**

3(3-0)

Science basics, law and regulations, protection of human health and the environment from air, water, solid/hazardous and product pollution. Structure of the environmental industry. Prerequisite: sophomore standing in physical science, engineering or agriculture.

#### **2372. Environmental Engineering in a Global Society.**

3(3-0)

The impact of environmental engineering solutions in a global and societal context, examined relative to technology, policy and regulation.

#### **3328. Environmental Engineering Process Fundamentals.**

3(3-0)

Physicochemical and biological process fundamentals and applications. Mass balance approaches to problem solving with consideration of water chemistry, environmental process kinetics, ideal reactors and biological process fundamentals. Prerequisite: EVEN 2310.

#### **3336. Environmental Microbiology.**

3(3-0)

Use and control of microorganisms in engineered systems and the effects of microorganisms on the environment and on human activity, health and welfare. Microbial structure, function, growth, metabolism and diversity, as well as microbial involvement biogeochemical cycling and in water and waste treatment, waterborne diseases and pollution control. Prerequisite: CHEM 1311.

**3420. Chemical Principles for Environmental Engineers.** 4(3-3)  
Fundamental chemical principles for determination of the source, fate and transformation of chemical compounds in natural and polluted environments. Climate change, air pollution, stratospheric ozone depletion, pollution and treatment of water sources and the utilization of insecticides and herbicides. Prerequisites: CHEM 1311, CHEM 3323.

**4110. Environmental Ethics Seminar.** 1(1-0)  
Familiarization and instruction for students in the recognition and formulation of ethical questions and issues centered about environmental engineering professional practice. Approaches to articulate and attempt resolution of ethical issues in engineering including safety and the environment. Prerequisite: junior and senior standing.

**4301. Water and Wastewater Treatment.** 3(3-0)  
Engineering analysis and design of water and wastewater treatment processes. Water quality evaluation; physical, chemical and biological treatment systems; design of facilities for production of drinking water and treatment. Prerequisites: MATH 3320, EVEN 2310, EVEN 3420.

**4302. Environmental Engineering Design I.** 3(3-0)  
Application of the scientific, engineering, technical and communication skills to a water resources related environmental engineering design topic. Sustainable development and communication skills are emphasized. Prerequisites: CEEN 3392, EVVEN 2310, EVEN 3420, EVEN 3328, EVEN 4301.

**4303. Environmental Engineering Design II.** 3(3-0)  
The application of environmental engineering principles, including sustainability and economic criteria to a comprehensive air pollution control design problem. Computer software is utilized as a design aid. Prerequisites: EVEN 3420, EVEN 3328, CHEN 4386.

**4306. Solid and Hazardous Waste Fundamentals.** 3(3-0)  
Solid and hazardous waste engineering and planning. Landfill technology development and design. Waste to energy concepts and technology development, and resource conservation and recovery perspectives. Prerequisite: EVEN 3328.

**4317. Environmental Engineering Fundamentals.** 3(3-0)  
Introductory course in Environmental Engineering: science basis, law and regulations, protection of human health and the environment from air, water, solid/hazardous and product pollution. Structure of the environmental industry. Prerequisite: junior standing in B.S. program in physical science, engineering or agriculture.

**4357. Environmental Aspects of Engineering Works and Products.** 3(3-0)  
Environmental transformations, contaminant transport, ideal reactor models, design and application of exposure assessment models to solve waste load allocation problems. Prerequisite: senior standing in engineering.

**Degree Requirements**  
**Bachelor of Science in Environmental Engineering**

<b>Freshman Year</b>			<b>Junior Year</b>		
CHEM 1311/1111	4	ENGL 1302	3	BCOM 2304	3
ENGL 1301	3	MATH 2414	4	CHEM 3323/3123	4
EVEN 1201	2	MEEN 1310	3	EVEN 3336	3
HIST 1301	3	PHYS 2325/2125	4	EVEN 3420	4
MATH 2413	4	<sup>^</sup> Literature/philosophy	3	POLS 2302	3
	16		17		17
<b>Sophomore Year</b>			<b>Senior Year</b>		
CHEM 1312/1112	4	BIOL 1306	3	CEEN 3317	3
EVEN 2310	3	CSEN 2304 or	3	CHEM 4386	3
HIST 1302	3	CSEN 2303		EVEN 4302	3
MEEN 2355	3	MATH 3320	3	EVEN 4306	3
POLS 2301	3	PHYS 2326/2126	4	STAT 4303	3
	16	<sup>^</sup> Visual/performing arts	3		15
			16		
				CEEN 3392	3
				EVEN 2372	3
				EVEN 3328	3
				EVEN 4301	3
				MEEN 3347 or	3
				CHEN 3347	
				<sup>^</sup> Social/behavioral	3
					18
				EVEN 4110	1
				EVEN 4303	3
				GEOL 4425 or	4
				PLSS 3410	
				Engineering Elective	3
				Engineering Elective	3
					14
<b>Total Hours Reqd: 129</b>					

**Engineering Electives (Choose six hours from one focus area):**

For Focus Area of Water Resources: CHEN 3321, CHEN 3392, CHEN 4279, NGEN 4337, CEEN 4364, CEEN 4362 or EEEN 3331.

For Focus Area of Air Pollution: NGEN 4337 or EEEN 3331.

For Focus Area of Geo-environmental: NGEN 4337, CEEN 4362, ITEN 4332 or EEEN 3331.

For Focus Area of Sustainability and Green Engineering: NGEN 4337, CHEN 3321, CHEN 4279 or EEEN 3331.

<sup>^</sup>For courses listed under Core Curriculum "Components" see "General Requirements for Graduation with a Baccalaureate Degree" in an earlier section of this Catalog.

## DEPARTMENT OF INDUSTRIAL TECHNOLOGY (ITEN)

Bruce Marsh, *Chair*

Gross Industrial Technology Building 100. MSC 203. Extension 2608.

### *Associate Professors*

Heidari, Marsh, Mullen

### *Lecturer*

Rosenkranz

The department prepares students for a wide array of management-oriented positions within manufacturing, construction, fabrication and oil field service as well as educational and governmental organizations.

A minor in Industrial Technology requires the following course work: ITEN 1311, ITEN 1315, ITEN 2301 and at least three approved advanced ITEN courses in a specified concentration.

### **The Educational Objectives of the Industrial Technology Program are:**

- 1. To prepare students for technology-related careers within industry, education, business and government.**
- 2. To provide students with an academic base for advanced studies and life-long learning opportunities and expectations.**
- 3. To provide students with a sense of ethics and ethical responsibility to their profession and society.**

#### **1201. Careers in Industrial Technology.** (ENGR 1201) 2(1-3)

An overview of career fields within the field of Industrial Technology. Course activities explore technological systems in manufacturing, construction, communication, energy, transportation and computer applications used within the field of Industrial Technology.

#### **1311. Technical CAD.** 3(3-1)

An introduction to a variety of mechanical drafting applications and techniques, including orthographic projection, pictorials, geometric dimensioning and tolerancing in pencil and Computer Assisted Drafting and Design.

#### **1315. Metalworking Processes.** 3(3-1)

An introduction to the processes and standards utilized in the manufacture of products from metal. Laboratory experiences include foundry, sheetmetal fabrication, welding and basic machine tool operation.

#### **2301. Industrial Electronics.** 3(3-1)

Industrial applications of electricity and electronics, including passive components, power utilization, solid state devices and electronic production techniques.

#### **2320. Industrial Materials.** 3(3-1)

An introduction to the sources, properties and testing of a variety of industrial materials. Laboratory experiences include destructive and nondestructive materials testing. Prerequisite: CHEM 1405 or equivalent and PHYS 1375 or equivalent.

#### **2330. OSHA for General Industry.** 3(3-1)

An introduction to OSHA's general industry standards and an overview of the requirements of the more frequently referenced standards. Standards will be reinforced with laboratory exercises and related problems.

#### **3300. Manufacturing Technology.** 3(3-1)

An introduction to basic manufacturing concepts, processes and tools, with examples in machine tool operations and mass production. Prerequisite: junior standing.

#### **3308. Industrial Plastics.** 3(2-2)

A survey of the characteristics and the processes utilized in producing products from industrial plastics. Includes laboratory experiences in fabrication, injection molding, laminating and vacuum-forming. Prerequisites: CHEM 1405 and ITEN 3300 or equivalent.

- 3310. Fluid Power.** 3(3-1)  
Systems, instruments and concepts utilized in the area of fluid power with emphasis on fundamental theories of operation, system design, component selection, maintenance and safety considerations. Includes an overview of fluid logic and electrical controls circuits. Prerequisite: PHYS 1375, PHYS 1305/1105, PHYS 1301/1101 or PHYS 2325/2125.
- 3311. Manufacturing Facilities.** 3(3-0)  
Study of principles, methods and techniques utilized in planning, operating and maintaining manufacturing and industrial facilities.
- 3313. Energy and Power Technology.** 3(3-1)  
An introduction to the basic principles of energy and power transmission for industrial technologists and non-engineers. Prerequisite: PHYS 1305/PHYS 1105 or equivalent.
- 3315. CAD/CAM.** 3(3-1)  
Application, economics and programming of Computer Numerical Control (CNC) machine tools. Prerequisite: ITEN 1315 or equivalent.
- 3321. Architectural CAD.** 3(3-1)  
Planning, design and drafting of residential and commercial buildings. Prerequisite: ITEN 1311 or consent of instructor.
- 3323. Cost Estimating and Project Planning.** 3(3-0)  
A survey of practical methods used in the development of cost estimates and project plans in manufacturing and construction. Emphasis is placed on the application of computer software to these problems. Prerequisite: junior standing.
- 3324. Industrial Controls.** 3(3-1)  
Digital electronics and the application of microprocessors to industrial controls. Laboratory experiences include problems in programming and control system interfacing. Prerequisite: junior standing.
- 3331. Construction Technology.** 3(2-2)  
Systems, materials and equipment utilized in residential and commercial construction. Includes regulatory and economic analysis of construction projects.
- 3343. Advanced Manufacturing Processes.** 3(3-0)  
A survey of the latest manufacturing processes that are used in order to produce products that cannot be produced with conventional manufacturing processes. Processes covered will include, non-traditional machining methods, abrasive machining, advanced casting methods, specialized welding methods and other high-end manufacturing processes used in manufacturing industries.
- 3349. Manufacturing Productivity.** 3(3-0)  
Planning workstations, developing work methods and establishing time standards for manufacturing operations. Prerequisite: junior standing.
- 3352. Inspection and Gaging.** 3(3-1)  
Systems, instruments and concepts utilized in the area of inspection and gaging with emphasis on traditional instruments and overviews into in-process and post-process inspection, contact and noncontact gaging and digital gaging.
- 3399. Industrial Internship I.** 3(3-0)  
Supervised on-the-job experience in an industrial/technical area related to the field of Industrial Technology. Prerequisites: junior or senior standing and an internship position within an industrial environment/company approved prior to course scheduling.
- 4303. Selected Topics.** 3(3-0)  
Investigations with industrial experts on one or more topics in current technologies. May be repeated up to a total of 6 semester hours. Prerequisite: senior standing.
- 4332. Hazardous Waste and Fire Safety.** 3(3-1)  
Study of fire prevention and hazardous substances. Hazard mitigation and containment polities will be reviewed.

- 4335. Senior Projects.** 3(3-0)  
Individual solution of selected problems in industrial technology under the direct supervision of a faculty member. Prerequisite: senior standing in industrial technology.
- 4336. Industrial Employment Seminar.** 3(3-1)  
Survey of job opportunities in construction and manufacturing through class discussion, field trips and independent research. Includes job hunting skills development, resume writing and job interviewing. Prerequisite: junior standing.
- 4352. Quality Assurance.** 3(3-1)  
Methods used to ensure quality production through the measurement and maintenance of desired product characteristics in manufacturing processes. Prerequisite: MATH 1316 or equivalent.
- 4353. Construction Management.** 3(3-1)  
Study of management techniques to solve the unique problems associated with a construction project. Emphasis on the management of manpower, materials, money and machinery. Prerequisite: ITEN 3331 or equivalent.
- 4362. Data Analysis and Decision Making.** 3(3-1)  
Concepts of data analysis, distributions, probability, regression analysis and other statistical analysis techniques with technological and industrial applications, reinforced by laboratory exercises using a spreadsheet application program. Prerequisite: junior standing.
- 4399. Industrial Internship II.** 3(3-0)  
Supervised on-the-job experience in an industrial/technical area related to the field of Industrial Technology. Prerequisites: senior standing, ITEN 3399 and an internship position within an industrial environment/company approved prior to course scheduling.

**Degree Requirements**  
**Bachelor of Science in Industrial Technology**  
**with a Minor in Business Administration**  
**Accredited by The National Association of Industrial Technology (NAIT)**

<b>Freshman Year</b>				<b>Junior Year</b>			
CISA 1301	3	ENGL 1302	3	ACCT 2301	3	ACCT 2302	3
ENGL 1301	3	HIST 1302	3	ITEN 2320	3	BLAW 3314	3
HIST 1301	3	ITEN 1311	3	ITEN 3310 or	3	ITEN 3300	3
ITEN 1201	2	<sup>^</sup> Literature/philosophy	3	ITEN 3313		<sup>^</sup> Visual/performing arts	3
ITEN 1315	<u>3</u>	MATH <sup>5</sup>	<u>3</u>	<sup>^</sup> Global learning	3	ITEN, adv. <sup>3</sup>	<u>3</u>
	14		15	ITEN, adv. <sup>3</sup>	<u>3</u>		15
					15		
<b>Sophomore Year</b>				<b>Senior Year</b>			
ECON 2301	3	BCOM 2304 or	3	ITEN 3315	3	ITEN 3399 or	3
ITEN 2330 or	3	COMS2374/		ITEN 3324	3	ITEN 4335 <sup>3</sup>	
or ITEN 4332		ENGL 2374		ITEN 3349	3	ITEN 4336	3
POLS 2301	3	ECON 2302	3	Business, adv. <sup>4</sup>	3	ITEN 4352	3
CHEM <sup>1</sup>	4	ITEN 2301	3	ITEN, adv. <sup>3</sup>	<u>3</u>	ITEN, adv. <sup>3</sup>	3
MATH <sup>5</sup>	<u>3</u>	POLS 2302	3		15	MGMT, adv.	<u>3</u>
	16	PHYS <sup>2</sup>	<u>3-4</u>				15
			15-16				

**Total Hours Req'd: 120-121**

Notes:

<sup>1</sup>CHEM 1405 or CHEM 1311/1111.

<sup>2</sup>PHYS 1375, PHYS 1305/1105, PHYS 1301/1101 or PHYS 2325/2125.

<sup>3</sup>Chosen from ITEN 3308, ITEN 3311, ITEN 3313, ITEN 3321, ITEN 3323, ITEN 3343, ITEN 3352, ITEN 3399, ITEN 4303, ITEN 4332, ITEN 4335, ITEN 4353, ITEN 4362 and ITEN 4399. NOTE: At least one of ITEN 3399 or ITEN 4335 must be taken in a degree plan

<sup>4</sup>Chosen from any advanced business course in: ACCT, CISA, BUAD, ECON, FINC, MGMT or MKTG.

<sup>5</sup>Any university MATH course except MATH 1350 and MATH 1351.

<sup>^</sup>For courses listed under Core Curriculum "Components" see "General Requirements for Graduation with a Baccalaureate Degree" in an earlier section of this catalog.

# DEPARTMENT OF MECHANICAL ENGINEERING AND INDUSTRIAL ENGINEERING

Selahattin Ozcelik, *Interim Chair*

Engineering Complex 303. MSC 191. Extension 2003.

## *Professors*

Abdul-Razzak, Elkassabgi, Ozcelik

## *Associate Professors*

Jin, Peel

## *Assistant Professor*

Li, Ryu, Zhou

## *Lecturer*

Wright

### **The Educational Objectives of the Mechanical Engineering Program are:**

- 1. To prepare undergraduate students for a lifetime career as practicing professional mechanical engineers.**
- 2. To prepare students to advance their studies and to engage in lifelong learning.**
- 3. To give students an understanding of professional responsibilities with respect to the economic, societal and ethical impacts of their actions.**

### **GENERAL ENGINEERING (GEEN)**

#### **1201. Engineering as a Career. (ENGR 1201)**

2(1-3)

Overview of the history of engineering, its disciplines and professional practice with emphasis on social responsibility and ethical behavior. Introduces each engineering discipline using three-week modules. It also provides basic skills, tools and techniques applied to problem solving, teamwork and communication necessary for academic and professional success.

### **MECHANICAL ENGINEERING (MEEN)**

#### **1201. Introduction to Mechanical Engineering as a Career. (ENGR 1201)**

2(1-3)

The art and practice of mechanical engineering and its role in society. Promotes critical and analytical thinking; gives basic skills for the engineering approach to problem-solving, engineering design process and reverse engineering; and introduces engineering ethics.

#### **1310. Computer Based Graphics and Design I.**

3(2-3)

Introduction to computer-aided engineering design and analysis; principles of graphics, solid modeling, integrated applications of software in engineering drafting, design and problem solving.

#### **1320. Elementary Numerical Methods and Engineering Problem Solving.**

3(2-3)

Engineering problem-solving using high level programming language and numerical computing software. Programming logic; linear algebra and matrices; solutions to systems of linear equations; interpolation and curve fitting; numerical integration and differentiation.

#### **2146. Engineering Measurements.**

1(0-3)

Basic experimental techniques and instrumentation commonly found in industry. Experimental planning and analysis. ASTM methods introduced. Data acquisition means studied. Significance of data and presentation (written and oral). Computer usage and report writing emphasized. Prerequisites: MATH 2414, PHYS 2326/2126, MEEN 1320 or CSEN 2304 and CEEN 2301.

#### **2302. Mechanics II (Dynamics). (ENGR 2302)**

3(3-0)

Kinematics of particles and rigid bodies; motion relative to translating and rotating reference frames. Kinetics of particles and rigid bodies: Newton's second law, work-energy and impulse and momentum. Introduction to vibrations. Prerequisites: CEEN 2301, MATH 2414 and MEEN 1320 or CSEN 2304.

**2355. Statics and Dynamics of Rigid Bodies.** (ENGR 2303) 3(3-0)  
Resultants of force systems. Equilibrium of rigid bodies. Friction. Centroids and moments of inertia. Kinematics and kinetics of particles and rigid bodies. This course cannot be taken for credit by CEEN and MEEN majors. Prerequisites: PHYS 2325/2125 and MATH 2414.

**3145. Material Science Laboratory.** 1(0-3)  
Tensile, impact, fatigue, hardness and hardenability, creep, phase and microstructure, corrosion testing and microscopic analysis. Ferrous and non-ferrous materials and polymers are studied. ASTM methods are introduced and applied. Introduction to data acquisition and recording. Reporting in both written and oral format. Prerequisite: CEEN 2301 or MEEN 2355 and MEEN 1310. Corequisite: MEEN 3344.

**3344. Materials Science.** 3(3-0)  
Atomic and crystal structure of materials. Chemical, mechanical, electrical and thermal properties of engineering materials. Materials selection and design. Prerequisites: CHEM 1311/1111 and MATH 2413 and credit or enrollment in PHYS 2326.

**3347. Thermodynamics.** 3(3-0)  
Basic laws governing energy transmission. Thermodynamic properties of liquids and vapors, the ideal gas law and the behavior of ideal gases. Concept of reversible process. Prerequisites: MATH 2414, MEEN 1320 or CSEN 2304.

**3348. Heat Transfer.** 3(3-0)  
Fundamental laws relating to heat transfer including steady and transient heat conduction, forced, convection, natural convection and radiation. Introduction to heat exchanger design. Prerequisites: MEEN 3347, CHEN 3392 and MATH 3320.

**3349. Fundamentals of Manufacturing Processes.** 3(2-3)  
Selection criteria for manufacturing processes, processing of castings, bulk deformation process, sheet metal working, polymer and polymer-matrix composite production, machining and welding processes. Prerequisite: MEEN 3344.

**3350. Design of Machine Elements.** 3(3-0)  
Application of principles of mechanics and physical properties of materials to the design of machine elements such as shafts, springs, power screws and gears. Prerequisites: CEEN 3311, MEEN 2302 and MEEN 3344.

**3352. Kinematics of Machines.** 3(3-0)  
Linkages, instant centers, velocities, accelerations and synthesis of mechanisms, cams gears and dynamic analysis of machines. Prerequisites: MATH 2414 and MEEN 2302.

*In addition to the listed prerequisites for the following 4000 series courses, a student must have an overall grade point average of 2 or higher.*

**4131. Mechanical Engineering Laboratory.** 1(0-3)  
Experimental investigation of mechanical engineering systems: engines, fluid flow, air conditioning, heat transfer devices, pumps and mechanical systems. Prerequisites: MEEN 3146, MEEN 3348.

**4263. Mechanical Engineering Design Projects I.** 2(1-3)  
Capstone design course emphasizing quantitative analytical/computer and experimental methods including optimization and simulation as applied to the design process for a broad range of practical problems in mechanical engineering. Integrates knowledge gained from all required mechanical engineering courses in a major system design project. Prerequisite: MEEN 3350.

**4264. Mechanical Engineering Design Projects II.** 2(1-3)  
Capstone design course emphasizing the application of analytical/computer and experimental methods to the solution of a broad range of practical problems in mechanical engineering. Integrates knowledge gained from all required mechanical engineering courses via the completion of a system design project. Prerequisite: MEEN 4263.

**4317. Internal Combustion Engines.** 3(3-0)  
Thermodynamics of cycles, comparison of characteristics and performance of several forms of internal combustion engines including Otto and Diesel types of piston engines. Fuels, combustion, injection and supercharging. Prerequisite: MEEN 3347.

- 4335. Special Problems.** V:1-3  
Individual solution of selected problems in mechanical engineering conducted under direct supervision of a faculty member. May be repeated for up to 6 semester hours. Prerequisite: senior standing.
- 4336. Selected Topics.** V:1-3  
One or more topics of mechanical engineering. May be repeated when topic changes. Prerequisite: senior standing.
- 4341. Application of Thermodynamics.** 3(3-0)  
Design of power and refrigeration systems, mixing (or separation), multiphase, air conditioning and energy conversion processes. Prerequisites: MEEN 3347 and MATH 3315.
- 4343. Dynamics of Systems.** 3(3-0)  
Analysis of dynamic-mechanical, electrical, fluid and thermal system elements; modeling, analysis and design of physical, dynamic systems composed of these elements. Prerequisites: MATH 3320, MEEN 2302 and MEEN 1320.
- 4344. Control of Systems.** 3(2-3)  
Analysis and design of controlled, dynamic, linear mechanical, electrical, fluid and/or thermal systems; introduction to concepts of stability, controllability, observability and to discrete time; sampled data control systems; optimal control systems and nonlinear control theory. Prerequisite: senior standing in Engineering.
- 4345. Engineering Vibrations.** 3(3-0)  
Free and forced vibrations, degrees of freedom, energy methods, transients, harmonic analysis, damping. Prerequisites: MATH 3320 and MEEN 2302.
- 4346. Computational Methods in Mechanical Engineering.** 3(3-0)  
Applications of numerical techniques to the solution of mechanical engineering problems. Prerequisites: MEEN 1320 and credit for or registration in MEEN 3348 or MEEN 3350.
- 4348. Gas Dynamics.** 3(3-0)  
Basic concepts and fundamental equations of gas dynamics. Emphasis on the subsonic and supersonic steady flow. Analysis of shock wave phenomena. Prerequisites: MATH 3320 and credit for or registration in MEEN 3348.
- 4349. Air Conditioning.** 3(3-0)  
Application of factors of temperature and humidity to the design of air conditioning systems. Design and applications of heating and cooling requirements, total energy systems, etc. Prerequisite: MEEN 3347.
- 4351. Machine Design.** 3(3-0)  
Design techniques of brakes, clutches, bevel, worm and helical gears, thick cylinders, flywheels, impact and elastic bodies, curved beams, flat plates and cams. Prerequisite: MEEN 3350.
- 4352. Design of Turbomachinery.** 3(3-0)  
Design and application of centrifugal and axial flow pumps and turbines, consideration of similarity parameters, real machine performance characteristics, materials and methods of construction, selection process for various applications. Prerequisites: MEEN 4341 and CHEN 3392.
- 4354. Introduction to the Finite Element Method.** 3(3-0)  
Principles and applications of the finite element method. Matrix and vector operations, structure and organization of finite element computer programs. Structural and nonstructural elements and applications. Prerequisites: MEEN 1320, MATH 3320, CEEN 3311 and senior standing.
- 4355. Robotics and Automation.** 3(3-0)  
Analysis of methods of design and operation of robots and robotic systems. Kinematics and dynamics of manipulators, trajectory planning and motion control, sensing and vision, discussion of command languages and planning of job assignments. Prerequisite: senior standing.

**4385. Manufacturing of Composites.**

3(2-3)

Introduction to composites manufacturing processes; hand lay-up, air and oven curing, filament winding and pultrusion. Structural design criteria of marine, aerospace, chemical and civil structures applied. Practical case studies and projects. Prerequisites: MEEN 3344 and CEEN 3311. Purchase of lab supplies required.

**Degree Requirements**  
**Bachelor of Science in Mechanical Engineering**

Accredited by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD  
 21202-4012 - telephone: (410) 347-7700

<b>Freshman Year</b>				<b>Junior Year</b>			
CHEM 1311/1111	4	ENGL 1302	3	CHEN 3392	3	CEEN 3317	3
ENGL 1301	3	HIST 1302	3	MEEN 3347	3	EVEN 2372	3
HIST 1301	3	MATH 2413	4	MEEN 3349	3	MEEN 3348	3
MEEN 1201	2	MEEN 1320	3	MEEN 3352	3	MEEN 3350	3
MEEN 1310	3	PHYS 2325/2125	4	POLS 2302	3	MEEN 4341	3
*Fine Arts Elective	<u>3</u>		17		15	POLS 2304 or	<u>3</u>
	18					POLS 2340	18
<b>Sophomore Year</b>				<b>Senior Year</b>			
CEEN 2301	3	***BCOM 2304	3	EEEN 3331	3	MATH 3415	4
MATH 2414	4	CEEN 3311	3	MEEN 4131	1	MEEN 4264	2
PHYS 2326	3	MATH 3320	3	MEEN 4263	2	Engineering Elective	3
POLS 2301	3	MEEN 2146	1	MEEN 4344	3	Engineering Elective	3
**Humanities B	<u>3</u>	MEEN 2302	3	MEEN 4351	3	STAT 4303	<u>3</u>
Elective	16	MEEN 3145	1	Engineering Elective	<u>3</u>		15
		MEEN 3344	<u>3</u>		15		
			17				
						<b>Total Hours Reqd:</b>	<b>131</b>

Engineering electives: MEEN 4317, MEEN 4335, MEEN 4336, MEEN 4343, MEEN 4345, MEEN 4348, MEEN 4349, MEEN 4352, MEEN 4354, MEEN 4355, MEEN 4385, CEEN 3303, CEEN 4316.

\*Fine Arts electives: ARTS 1303, ARTS 1304, MUSI 2308, MUSI 2310.

\*\*Humanities B Elective - Any 2000 level course satisfying the General Education Requirement.

\*\*\*BCOM 2304: required course. ENGL 2374/COMS 2374 can be substituted upon approval of adviser and department chair.

*^For courses listed under Core Curriculum "Components" see "General Requirements for Graduation with a Baccalaureate Degree" in an earlier section of this Catalog.*

## **SOUTH TEXAS ENVIRONMENTAL INSTITUTE**

*Director*

Engineering Complex 376. MSC 213. Extension 3046

The South Texas Environmental Institute was established in 2001 with the mission to promote regional sustainability by fostering the ideals of environmental protection while encouraging regional economic growth. The Institute promotes applied research, technology development and transfer and environmental education to the South Texas region by 1) promoting the use of innovative sustainable technologies in all aspects of South Texas life, 2) fostering applied research for the development and transfer of technologies that ensure an equitable balance between ecological, environmental and occupational health and continued economic growth of the region, 3) providing individuals, institutions and communities access to resources that ensure a knowledgeable populace equipped with an understanding of environmental issues for making informed decisions and 4) promoting and providing for coordination and consolidation environmental activities on a regional scale. Trans-boundary environmental issues with Mexico and the Gulf of Mexico along its coast are a key focus area in the Institute's charter. Activities such as the South Texas Environmental Conference Series, held annually in both the Coastal Bend and the Rio Grande Valley, in addition to the regional research emphasis, has resulted in partnerships and collaborations with organizations and individuals from throughout the South Texas region.

