College of Engineering

Departments: Chemical Engineering, Civil Engineering, Electrical Engineering, Industrial Engineering, and Mechanical Engineering

Jack R. Hopper, Dean — **2016 Cherry Engineering Building, Phone 880-8741**

Ronald Peevy, Director, Recruiting and Cooperative Education — **2612 Cherry Engineering Building, Phone 880-7870**

Katrina Brent, Director, Engineering Marketing — **2616 Cherry Engineering Building, Phone 880-7797**

Becky Caddy, Director, Advisement and Retention Center — **2612 Cherry Engineering Building, Phone 880-8810**

Debbie Graves, Executive Assistant

Engineering Endowed Chair Professors:

Michael E. and Patricia P. Aldredge Chair of Industrial Infrastructure: T.C. Ho

Jack Gill Chair of Chemical Engineering and Chemistry: David Cocke

Andrew and Joyce Green Chair of Composites and Structural Engineering: Robert L. Yuan

William B. and Mary G. Mitchell Chair of Telecommunications: Harley Myler

Degrees Offered

Engineering

B.S., Bachelor of Science in
- Chemical Engineering
- Civil Engineering
- Electrical Engineering
- Industrial Engineering
- Mechanical Engineering
- Industrial Technology

M.E.S., Master of Engineering Science

M.S., Master of Science in
- Environmental Engineering
- Environmental Studies

M.E., Master of Engineering

M.E.M., Master of Engineering Management

D.E., Doctor of Engineering

Ph.D., Chemical Engineering

The mission of the College of Engineering is to provide an environment and infrastructure to support the educational objectives of its programs. The College establishes an interface to the University and entities external to the University to provide and prepare engineering students to be leaders and problem-solvers. The College supports a foundation of strong theoretical emphasis, the development of practical engineering skills, experience in interpersonal communication and teamwork, and an emphasis on ethics, professional conduct and critical thinking. We offer strong and varied academic programs to a diverse student population that prepares our graduates for the challenges of lifelong learning.

The departments in the College of Engineering are associated with their respective national honor societies which include: Alpha Pi Mu, Chi Epsilon, Eta Kappa Nu, Omega Chi Epsilon, Pi Tau Sigma and Tau Beta Pi.

Cooperative Education Program

A Cooperative (Co-op) Education Program, in which the student spends alternate terms at work and at study, is offered to qualified students in the College of Engineering. Internships for work periods in summer terms only are also offered. Programs are available for engineering and industrial technology students.

To meet the minimum qualifications for the Co-op program a student must

1. Complete all the work in the first two semesters of the degree program.
2. Maintain a 2.5 over-all grade point average.

To remain in the program, the student must maintain a grade point average above a 2.5 and perform in a manner satisfactory to the employer and Lamar University.

A co-op is considered to be a full-time student during any work term in which the co-op is registered for Career Development. By participating in the Co-op program throughout the sophomore and junior years, a student extends the time required to obtain a degree to five years. However, in doing so, he gains the equivalent of almost two years experience in industry.

A student may apply for admission to the Co-op program through the Engineering Cooperative Education Office.

Co-op Courses (INEN)

2361 Career Development I **3:3:0**
Comprehensive treatment of career-related special assignments and projects.
Prerequisite: Approval of academic dean.

2370 Career Development II **3:3:0**
Comprehensive treatment of career-related special assignments and projects.
Prerequisite: ENGR 2361.

3361 Career Development III **3:3:0**
Comprehensive treatment of career-related special assignments and projects.
Prerequisite: ENGR 2370.

3370 Career Development IV **3:3:0**
Comprehensive treatment of career-related special assignments and projects.
Prerequisite: ENGR 3361.

4360 Career Development V **3:3:0**
Comprehensive treatment of career-related special assignments and projects.

Engineering Programs

The five undergraduate curricula in engineering are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET). The ABET defines engineering as "the profession in which a knowledge of the mathematical and natural sciences gained by study, experience and practice is applied with judgment to develop ways to use economically the materials and forces of nature for the benefit of mankind." Clearly, from this definition, engineers are to form the interface between science and society as they apply, in realistic terms, the findings of science.

Entrance Requirements

Entering freshmen and new transfer students are considered provisional majors. The College of Engineering Advisement Center is responsible for the academic advisement of provisional engineering majors.

The entrance requirements from high school for engineering degree programs are

1. English ..... 4 units
2. Mathematics
   - Algebra ..... 2 units
   - Geometry ..... 1 unit
   - Pre-calculus or Equivalent ..... 1 unit
3. Natural Sciences
   - Chemistry ..... 1 unit
   - Physics ..... 1 unit
4. Foreign Language ..... 1 unit

Students who meet the general entrance requirements of the University, but lack in specific requirements for the engineering curricula may, upon approval of the dean, be permitted to enroll in the College of Engineering; however, all deficiencies must be removed before the end of the second academic year. Students having entrance deficiencies or weaknesses are urged to use the summer terms proceeding the Freshman year in college to remove them. Students attaining a sufficiently high grade in the CEEB Mathematics Level I exam may be eligible for advanced placement in the Calculus and Analytic Geometry sequence. These tests are administered during the freshmen orientation periods and during the regular registration periods.

Transfer students are required to have a minimum 2.0 GPA on all work attempted before entering the College of Engineering. Normally transfer credit is considered for course work with a grade of "C" or better.

Standards

In addition to the University requirements, the College of Engineering enforces the following standards:

1. Students are required to take courses in the sequence shown in the University Bulletin for each degree program.
2. Engineering students are expected to maintain a GPA of 2.25 to remain in a program. Students who drop below 2.25 GPA will be placed on probation (maximum load of 13 semester hours). Students who drop below a 2.0 GPA will be suspended from the College of Engineering for one long term. Students returning from suspension must prepare a performance contract in consultation with their academic advisor. A minimum term of the contract requires the student to remove deficiencies every semester of enrollment. Students who fail to meet the terms of their contract will be permanently suspended.
3. Engineering students are expected to maintain a minimum GPA of 2.0 in their major courses (Any course with an Engineering prefix.) A performance contract with the student's department head is required for continued enrollment.
4. Degree credit is normally allowed only for courses in which a grade of "C" or better is earned. A course may be repeated for additional credit toward a degree only as specified by the official course description in the University Bulletin. Excluding courses that may be taken for additional credit toward a degree, a student may not register for any course more than four times. Any student who wishes to repeat a course must do so before completing a more advanced course in the same subject matter field.

5. Upon the completion of at least 51 semester hours of the Common Program with a GPA of 2.25 or more on all required courses, a student will be considered for admission to an engineering program. For all engineering programs, it is required that 45 semester hours (at least 25 semester hours in engineering at the 3000 and 4000 level) be earned after admission to the professional program.
6. The student's advisor must approve all electives.

The Dean of Engineering may require students to meet the current degree requirements or program standards.

Please see each department's four-year suggested program of study.

Engineering Courses (ENGR)

The following courses are common to all engineering programs.

4101, 4201, 4301 Special Topics **1-4:A:0**
An investigation into specialized areas of engineering under the guidance of a faculty member. This course may be repeated for credit when topics of investigation differ.

4306 ENGR Internship 1 **3:3:0**
Internship opportunity provides experience in the practice of engineering for undergraduate students. Its purpose is engineering career development.

4307 ENGR Internship 2 **3:3:0**
Internship opportunity provides experience in the practice of engineering for undergraduate students. Its purpose is engineering career development.

4308* ENGR Internship 3 **3:3:0**
Internship opportunity provides experience in the practice of engineering for undergraduate students. Its purpose is engineering career development.

4309* ENGR Internship 4 **3:3:0**
Internship opportunity provides experience in the practice of engineering for undergraduate students. Its purpose is engineering career development.

Pending approval by the Texas Higher Education Coordinating Board

Department of Chemical Engineering

Program accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology.

Department Chair: Thomas Ho **101 Lucas, Phone 880-8784**

Professors: Hopper, Yaws, Li, Chen, Ho

Gill Chair in Chemical Engineering and Chemistry: Cocke

Associate Professors: Gossage, Lou, Richmond

Assistant Professors: Lin, Tadmor, Xu

Research Assistant Professor: Wang

Laboratory Technician: Kelly Clarke

Administrative Associate: Dewanna Campbell

Chemical engineering is the profession in which a knowledge of mathematics, chemistry and other natural sciences gained by study, experience and practice is applied with judgment to develop economic ways of using materials and energy for the benefit of mankind. The chemical engineer enters into almost every modern industry. From petroleum to synthetic rubber, from semiconductor to medicines, the chemical engineer engages in design, research, development, production, sales and management. Among the fields in which the chemical engineer is of prime importance are petroleum, petrochemicals, metals, plastics, paints, drugs and foods, paper, glass, dyes, synthetic fibers and a host of others.

The Department of Chemical Engineering will permit transfer of up to 78 semester hours from a junior college or a community college, if appropriate courses were taken at the junior (community) college level. The appropriate list of courses for a particular college can be made available upon request.

Mission Statement

The Chemical Engineering Department will provide the program, environment, facilities, faculty, and staff to prepare and educate each student to be a leader/problem-solver for industry, academia, or government.

Educational Objectives

The Chemical Engineering Department will educate students to have

(1) The foundation and depth of knowledge for problem-solving in their careers,
(2) The foundation and breadth of knowledge for obtaining, applying, and conveying knowledge across disciplines; and
(3) Effective communication skills for teamwork and leadership.

The department recognizes that students, faculty, alumni, and employers of graduates have a stake in the success of its program. These constituencies play a role in determining the mission and objectives of the department, and they will play a role in determining how well these objectives are being met.

Bachelor of Science – Chemical Engineering

Suggested Program of Study – Total Min. Hours: 141

First Year

Fall Semester		Spring Semester	
ENGL Comp	3	ENGL Comp	3
MATH 2413 Calculus & Anal Geom I	4	MATH 2414 Calculus & Anal Geom II	4
CHEM 1411 Gen Chemistry	4	CHEM 1412 Gen Chemistry	4
INEN 1101 Intro Engineering	1	*ELEN 1301 Eng Computers I	3
PHIL 1370 Philosophy of Knowledge	3	PHYS 2425 Mechanics & Heat	4
PEGA	1		
Fine Arts	3		
	19		18

Second Year

MATH 3370 Statistics	3	Soc Sci Elective	3
PHYS 2426 Elec, Mag, Lt.snd	4	CHEM 3401 Quant Anal	4
INEN 2273 Eng Econ	2	*CHEN 3340 Proc Anal	3
CVEN 2301 Statics	3	ELEN 2310 Fund of Elec Eng	3
*CHEN 2374 Thermodynamics I	3	MATH 3301 Diff Equa & Lin Alg	3
*CHEN 2100 CAMS	1	#CHEN 2140 Seminar	1
Eng Lit	3		
	19		17

Third Year+

**CHEN 3330 Thermo II	3	**CHEN 3320 Heat Transfer	3
**CHEN/MEEN 3311 Mom Trans	3	**CHEN 4410 Kinetics	4
POLS 2301	3	POLS 2302	3
CHEM 3411 Organic I	4	CHEM 4312 Physical	3
COMM/Modern Languages	3	CHEM 3412 Organic II	4
MATH 2318 LA I	3		
	19		17

Fourth Year

CHEN 4331 Proc Control I	3	CHEN 4332 Proc Control II	3
CHEN 4420 Mass Transfer	4	CHEN 4150 Proc Cont Lab	1
# CHEN 4310 Lab	3	CHEN 4340 Design II	3
CHEN 4360 Design I	3	CHEN 4350 Adv Anal	3
Am Hist	3	Am Hist	3
		CHEM Elect (1)	3
	16		16

(1)Approval of Department Head
** Courses offered during both the fall and spring semester*
*** Courses also offered during the summer session*
+ Completion of CHEN & CHEM courses required before registration for fourth-year CHEN courses
 # Extensive Oral Communications Requirement

Chemical Engineering Courses (CHEN)

2100 Computer-Aided Modeling and Simulation **1:0:3**
Introduction to mathematical and chemical process simulation software packages that will be useful to the students in their later chemical engineering courses.
Prerequisite: CHEN 3340 or concurrent.

2374 Thermodynamics **3:3:0**
The fundamental laws of thermodynamics; properties of systems solids, gases and liquids, and thermodynamic tables.
Prerequisite: ELEN 1301, PHYS 2425, MATH 2415 or concurrent.

3311 Momentum Transfer **3:3:0**
Fluid-flow concepts are presented through the derivation of the basic equations of continuity, energy and momentum. Engineering aspects of flow measurement, pressure-drop calculations and pumping requirements are considered. Same as MEEN 3311. CHEN 3311 and MEEN 3311
may not both be counted for credit.
Prerequisite: CHEN 3340.

3320 Heat Transfer **3:3:0**
Principles of conduction, convection and radiation, and their application to the design of heat transfer equipment and systems.
Prerequisite: CHEN 3311, CHEN 3330.

3330 Thermodynamics II **3:3:0**
Application of the First and Second Laws to chemical processes. Thermodynamic properties
of pure fluids and mixtures. Physical equilibrium.
Prerequisite: CHEN 3340, CHEM 3411 or concurrent.

3340 Process Analysis **3:3:0**
Application of mathematics, physics and chemistry to the solution of problems in industrial chemistry. Material and energy balance calculations on processes undergoing physical and chemical changes.
Prerequisite: CHEN 2374 or concurrent.

4140 Seminar **1:1:0**
Oral and written presentation of selected topics in chemical engineering from recent technical publications.
Prerequisite: Sophomore standing in Chemical Engineering.

4150 Process Control Laboratory **1:0:3**
Experiments in level, flow and temperature control; computer-based adaptive control; PID tutorial program; control valve selection and sizing; interactive process control using the Honeywell TDC-3000 keyboard with a process control simulator.

4310 Laboratory I **3:1:6**
Experiments in heat transfer, mass transfer, fluid flow, reaction kinetics and thermodynamics.
Prerequisite: CHEN 3311, 3320, CHEN 4420 or concurrent.

4331 Process Control **3:3:0**
Basic hardware and instrumentation needed to implement process control; principles of feedback controllers design and tuning; analysis of stability and performance of feedback loops using Laplace and frequency domain techniques. Introduction of advanced control strategies.
Prerequisite: CHEN 4410, 4420, MATH 3301.

4332 Process Control II **3:3:0**
This course covers enhanced PID control, multivariable constrained control and statistical process control. Control and simulation software will be used.
Prerequisite: CHEN 4331.

4340 Plant Design II **3:3:3**
A continuation of CHEN 4360, with emphasis on a major design project.
Prerequisite: CHEN 4360.

4350 Advanced Analysis **3:3:0**
Development of mathematical equations for chemical engineering applications. Implementation of computer-aided modeling and simulation packages in chemical engineering applications.
Prerequisite: CHEN 3330, 3311, 3320, 4570, 4410, MATH 3401.

4360 Plant Design I **3:3:0**
Application of chemical engineering principles to the design of chemical processes and plants. Equipment design and specifications. Economic evaluation of processes and equipment.
Prerequisite: INEN 2273, CHEN 4410, CHEN 4420 or concurrent.

4410 Reaction Kinetics **4:3:3**
Chemical equilibrium. Analysis of experimental data to determine reaction rate parameters in homogeneous, heterogeneous, catalytic and non-catalytic reactions. Development of equations for batch, stirred-tank and tubular flow reactors. Application of differential equations to process and reactor design.
Prerequisite: MATH 3301, CHEN 3320 or concurrent, CHEN 3330 or concurrent, CHEM 3411 or concurrent.

4420 Mass Transfer **4:3:3**
Principles of diffusion. Simultaneous mass, energy and momentum transfer. Analysis of absorption, extraction and distillation processes.
Prerequisite: CHEN 3330, 3320, CHEM 3411.

Department of Civil Engineering

Program accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology.

Department Chair: Robert Yuan **2010 Cherry Building, Phone 880-8759**
Web Address: http://ceserver.lamar.edu

Andrew and Joyce Green Chair of Composites and Structural Engineering: Robert Yuan

Professors: Koehn, Yuan

Associate Professors: Jao, Lin

Assistant Professor: Bourland, Qian

Instructor: Majdalani, Tohme

Laboratory Technician: Hall

Administrative Associate: Dousay

Civil engineering is a people-serving profession and as such is vital to the world's economic, political, and social well being. The many areas to which civil engineers make substantial contributions include bridges, dams and levees, harbors, waterways and irrigation facilities, buildings, airports, highways, pipelines, railroads, power lines, water supply systems and waste treatment facilities. Civil engineers engage in a wide range of activities such as research, design, development, management, and the control of engineering systems and their components. With today's fast-paced technological changes, civil engineering provides unique and unlimited career opportunities that can only be met by professionally educated people.

The civil engineering program is designed with a broad base to prepare men and women for careers in various phases of civil engineering and to enable them to perform other managerial and technical functions that require scientific and engineering backgrounds. The curriculum embraces a sound core of humanities and social studies courses in addition to those in physics, chemistry and mathematics, which form the substructure of engineering sciences. Areas of study include geo-technical, structural, water resources, environmental, surveying, and construction engineering. Electives are available to fit the individual interest of the civil engineering student.

Because of the wide scope of activities in which the civil engineer is engaged, and the broad spectrum of student interest, civil engineering graduates may choose either to enter the profession immediately after receiving their bachelor's degree or go directly to graduate school. No matter what the student chooses, the curriculum provides a firm foundation for today's world.

To encourage and assist scholars in civil engineering, the Katherine E. and William C. Mundt endowment was established in 1983. In addition, the Tony Paine Memorial Scholarship was established in 1988, the David Bernsen Endowed Scholarship in 1997 and the Leslie A. Lakie Scholarship in 1999 and many others. These funds provide scholarships for qualified students. Application forms are available in the civil engineering department office.

Mission Statement

Our mission is to provide quality education and meaningful career opportunities for both undergraduate and graduate students. We develop highly qualified graduates with potential to assume positions of increasing responsibility in Civil and Engineering. The Department will achieve its mission through continuous efforts to: (1) employ a faculty with the professional credentials and experience to deliver quality academic programs that meet student and societal needs; (2) serve a diverse student population by offering strong and varied academic programs that will prepare graduates for the challenges of life-long learning; (3) offer contemporary curricula that combine a foundation of general education and disciplinary preparation for the market place; and (4) provide both formal and informal learning resources to support instructional and scholarly/creative activities.

Vision Statement

Lamar University's Department of Civil Engineering strives to become recognized as a regional/national/international leader in engineering education as well as in the analysis, design, and management of civil and environmental engineering systems. To support this endeavor, the department will seek to conduct, disseminate and apply relevant research to influence engineering practice and the advance of engineering education and knowledge. This will be accomplished through strategic efforts that allow the department to effectively adapt to the ever-changing aspects of higher education. The net effect will be that Lamar University's civil engineering graduates will be empowered with the knowledge, skills, and innovative thinking to facilitate discovery in numerous existing and yet to be discovered fields of endeavor.

Objectives

The objectives of the Department of Civil Engineering at Lamar University are to provide a high quality engineering education in which graduates are prepared to:

(1) understand and solve general civil engineering problems and be prepared for a successful career and for life-long learning;

(2) contribute in a multidisciplinary team and communicate effectively to various audiences;

(3) be a productive member of society and understand the importance of professional ethics, professional licensing, and global and environmental impacts; and

(4) be a leader in his/her technical field at the regional, national or international level.

Outcome Assessment

The Civil Engineering Department has developed an assessment process to demonstrate that the outcomes important to the objectives of its program are measured. This process is based on input from the department's various constituencies: alumni, employers, industrial practitioners, CE Advisory Council members, students and CE faculty. The process used in Program Educational Outcomes assessment for quality assurance includes:

(1) choose outcomes for direct measurement,
(2) identify performance criteria,
(3) develop rubrics and standards for evaluation,
(4) perform evluation and direct measurement for 1 through 3,
(5) college data from other outcome assessment instruments,
(6) collectively assess for program outcome achievement using collected data, and
(7) recommend implement improvement.

The Civil Engineering Department has used a mixed mode of assessment for program educational outcomes, which includes a) rubrics and dimensions in direct measurement; b) surveys for alumni, employers, industrial practitioners and graduating seniors for indirect measurement; and c) individual course assessment by instructor.

Civil Engineering Program Outcomes

The following outcomes are achieved in one or more courses in the BSCE curriculum. Graduates will:

(1) have an ability to apply knowledge of mathematics, science and engineering
(2) have an ability to design and conduct experiments, analyze and interpret data
(3) have an ability to design a system, components or process to meet desired needs
(4) have an ability to function on multi-disciplinary teams
(5) have an ability to identify, formulate and solve engineering problems
(6) have an understanding of professional and ethical responsibility
(7) have an ability to communicate effectively
(8) have the broad education necessary to understand the impact of engineering solutions in a global and society context
(9) recognize the need for and ability to engage in life-long learning
(10) have a knowledge of contemporary civil engineering issues
(11) have an ability to use the techniques, skills and modern engineering tools necessary for engineering practice

Bachelor of Science – Civil Engineering

Additional Degree Requirements:

Candidates for degrees in this program are strongly encouraged to consider sitting for the National Council of Engineering Examiners Examination on "Fundamentals of Engineering" as administered by the Texas Board of Professional Engineers.

Suggested Program of Study – Total Min. Hours: 133

First Year

Fall Semester		Spring Semester	
ENGL 1301 Composition	3	ENGL 1302 Composition or ENGL 1374	3
MATH 2413 Calculus & Anal Geom I	4	MATH 2414 Calculus & Anal Geom II	4
CHEM 1411 Gen Chemistry	4	COSC 1371 Intro to Microcomputers	3
INEN 1101 Intro Engineering	1	PHYS 2425 Calculus-based Physics I (1)	4
PHIL 1370 Philosophy of Knowledge	3	Communication/Modern Language	3
PEGA	1		
	16		17

Second Year

MATH 2415 Calc & Anal Geom III	4	INEN 2273 Eng Econ	2
PHYS 2426 Calculus-based Physics II	4	MEEN 2302 Dynamics	3
CVEN 2301 Statics	3	CVEN 2372 Mechanics of Solids	3
MATH 2318 Linear Algebra	3	MATH 3301 Ordinary Diff. Equations	3
CVEN 2270 Surveying	2	Elective: History I (2)	3
		CHEN 2374 themodynamics I	3
	16		17

Third Year

CVEN 3310 Water Chemistry in Environmental Engineering	3	CVEN 3200 Materials Engineering	2
CVEN 3340 Structural Analysis	3	CVEN 3360 Engineering Hydrology	3
CVEN 3350 Hydraulics	3	CVEN 3370 Water and Wastewater Treatment	3
CVEN 3290 Eng. Probability & Statistics	2	CVEN 3390 Geotechnical Engineering	3
Fine Arts Elective(4)	3	Science Elective (6)	3
Elective: History II	3	Elective: Literature	3
	17		17

Fourth Year

CVEN 4212 Civil Engr Syst Design Project	2	CVEN 4110 Seminar	1
CVEN 4320 Project Mgmt Engineering	3	CVEN 4350 Hydraulic Engineering	3
CVEN 4340 Foundation Engineering	3	CVEN 4390 Structural Steel Design	3
CVEN 4380 Reinf. Concrete Design	3	CVEN Elective (5)	3
CVEN Elective (5)	3	Social Science Elective (3)	3
POLS 2301 American Government I	3	POLS 2302 American Government II	3
	17		16

Notes:

(1) Communication 1315, 1360, 2335, 2373, 3310, or 3340; or CMDS 2375; or an introductory modem language course.
(2) Two semesters of US or Texas history from HIST 1301, 1302, 1361, 1362, 2373, 2374, 2377, 2301.
(3) Social Science electives are: ECON 1301, PSYC 2301, ANTH 2346 or 2351, SOCI 1301, or (both ECON 2302 and ECON 2301).
(4) Fine Arts Electives are: ARTS 1301, DANC 2304, HUMA 1315, MUSI 1306, or THEA 1310.
(5) Must be approved by the department chair. CVEN electives are: CVEN 4300, 4310, 4360, 4370.
(6) Science elective – min. 3 hours: GEOL 1403, BIOL 1406 or PHYS 3350.

Civil Engineering Courses (CVEN)

2270 Surveying **2:1:3**

Introduction to the basic principles of surveying. Use of equipment for measurement of horizontal and vertical distances and angles. Field practice and calculations associated with design and layout of highway curves including vertical and horizontal alignments. Transition spirals. Error Analysis. Computer used in calculations.
Prerequisite: INEN 1301, 1101.
Corequisite: MATH 2312.

2301 Statics

Statics of particles and rigid bodies. Use is made of basic physics, calculus and vector algebra.
Prerequisite: PHYS 2425.

2372 Mechanics of Solids **2:1:3**
Effect of loads on deformable bodies. Uniaxial and biaxial stress-strain relationships. Indeterminate systems. Study of stresses due to axial, torsional and bending effects. Bucking of columns. Introduction to design.
Prerequisite: CVEN 2301.

3200 Materials Engineering **2:0:6**
Principles/techniques for investigating properties and behavior of engineering members and materials using experimental methods. Consideration of design parameters.
Prerequisite: CVEN 2372.

3290 Engineering Probability and Statistics **2:2:0**
Principles of systems analysis utilized for solving civil engineering problems. Application of probability, statistics, and regression analysis to the engineering design process. Specific examples in civil engineering taken under consideration. Course title and description may vary when taught as a CE Elective.
Prerequisite: MATH 2415.
Corequisite: CVEN 2372.

3310 Water Chemistry in Environmental Engineering **3:2:3**
Introduction to the hydrologic cycle and the chemistry and microbiology of the natural aquatic environment. Emphasis is on the physical, chemical and biological characterization of water and wastewater systems in relation to man's environment. Laboratory work is in the physical, chemical and biological analysis of water and wastewater.
Prerequisite: CHEM 1411.

3340 Structural Analysis **3:2:3**
Analysis of loading for bridges and buildings. Effects of moving loads using influence lines. Shear and bending moment diagrams. Analysis of indeterminate structures. Introduction to structural design. Investigation of frames, girders and bents.
Corequisite: MATH 3301.
Prerequisite: CVEN 2372.

3350 Hydraulics **3:2:3**
Basic principles of fluid flow. Friction and drag studies. Calibration and design of flow measuring devices. Flow characteristics of open and closed conduits. Presentation of oral and written design reports.
Prerequisite: MEEN 2302.

3360 Engineering Hydrology **3:3:0**
Precipitation, surface water, infiltration, and sub-surface water. Analysis of rainfall and runoff data. Collection studies. Hydraulics of wells. Net storm rain; peak discharge and flood runoff.
Corequisite: MEEN 2302.

3370 Water and Wastewater Treatment **3:3:0**
General survey of environmental engineering covering water supply and sanitary sewerage treatment systems. Design of drinking water and wastewater treatment facilities.
Prerequisite: CVEN 3310, CVEN 3350.

3390 Geo-technical Engineering **3:2:3**
Basic principles of soil behavior under load. Soil properties and classification. Study of hydraulics as applied to soil mechanics.
Prerequisite: INEN 1101. Corequisite: CVEN 2372, MEEN 2302.

4110 Seminar **1:1:0**
Discussion of ethical, professional, and technical topics related to the practice of civil engineering. Presentation of oral and written reports.
Prerequisite: Senior standing.

4212 Civil Engineering Systems Design Project **2:0:6**
Planning, design, and analysis of a civil engineering system or project; an integrated and realistic group project is utilized which involves numerous major aspects of the civil engineering profession. Presentation of oral and written design reports.
Prerequisite: CVEN 3370, CVEN 3390. Corequisite: CVEN 4380, CVEN 4390.

4300 Advanced Structural Analysis **3:3:0**
Methods of statically indeterminate structural analysis including consistent deformation, slope deflection and moment distribution; introduction of stiffness and flexibility methods using matrix algebra, theory of arches, cables, cylindrical structures using classical and energy methods.
Prerequisite: CVEN 3340

4310 Building Design/Construction **3:3:0**
Advanced topics in Building and/or Construction Systems. Topics may include the treatment of contaminated soils, and the effects of various static, dynamic, hydraulic, and wind loads on structural frames and foundations. Environmental, social, and safety requirements may be taken under consideration. Presentation of oral and written design reports. May be repeated for credit when topics vary.
Prerequisite: Senior standing.

4320 Engineering Project Management **3:3:0**
Principles governing the effective and efficient management of engineering projects including the application of comprehensive planning, scheduling, and cost estimation procedures. Presentation of oral and written design reports.
Prerequisite: Senior standing.

4340 Foundation Engineering **3:2:3**
The practice of geotechnical engineering: subsurface explorations; geotechnical analysis and design of shallow footings, deep foundations, and retaining structures; stability of earth slopes, and soil improvement.
Prerequisite: CVEN 3390.
Corequisite: CVEN 4380.

4350 Hydraulic Engineering **3:2:3**
Continuation of CVEN 3350-Hydraulics I emphasizing practical design applications of basic fluid mechanics principles in fluid measurement, machinery, closed conduit flow, open channel flow and hydraulic transients. Presentation of oral and written design reports.
Prerequisite: CVEN 3350.

4355 Advanced Environmental Engineering System **3:3:0**
Advanced topics in environmental engineering. Typical topics may include solid waste management, fundamentals and control strategy of air pollutants, advanced water and wastewater treatment, industrial waste treatment, hazardous waste management and research topics in environmental science and engineering. Maybe repeated for credit when topics vary.
Prerequisite: CVEN 3310, CVEN 3370

4360 Hydraulic and Hydrological Modeling **3:3:0**
Advanced topics in hydraulic and hydrological models for water resource engineering system design and analysis. It may include models for watershed hydrological and floodplain hydraulic analysis, and also models for urban stormwater drainage system design and analysis. May be repeated for credit when subject matter varies.
Prerequisite: CVEN 3350
Corequisite: 3360, 4350

4370 Computer Aided Design **3:3:0**
Introduction of graphical computer-aided techniques to design various civil engineering systems. It may include introduction of AutoCAD and MicroStation, and also introduction of geographical information system (GIS - ArcView or Arc/Info) to analyze spatial data for feasibility study. May be repeated for credit when subject matter varies.
Prerequisite: Junior and Senior Standing

4380 Reinforced Concrete Design **3:2:3**
The design of structural concrete members based upon working stress and strength design methods. Study of standard specifications. Introduction to pre-stressed concrete.
Prerequisite: CVEN 3340.

4390 Structural Steel Design **3:2:3**
The design of buildings and bridge components according to standard specifications. Application of load and resistance factor and allowable stress design methods. Introduction to plastic design of steel structures.
Prerequisite: CVEN 3340.

Phillip M. Drayer
Department of Electrical Engineering

The Bachelor of Science – Electrical Engineering (BSEE) program is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET). This accreditation has been continuously maintained since 1958.

Department Chair: Harley R. Myler **2006 Cherry Building, Phone 880-8746**

Mitchell Endowed Chair in Telecommunications: Myler **Fax 409-880-8121**

Professors: Bean, Myler **e-mail: admin@ee.lamar.edu**

Associate Professor: Reddy, R. Wang **Web page: http://ee.lamar.edu**

Assistant Professors: Sayil

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Instructor: Hirano

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Administrative Associate Senior: K. Jane Stanley Capps

The undergraduate program in electrical engineering at Lamar University enjoys a long history of excellence in teaching. The program prepares graduates for a wide range of opportunities by providing a curriculum strongly based in mathematics and physics and the latest state-of-the-art material in electrical engineering, including photonics, image and signal processing, instrumentation, and computer and network systems design. The interested student has ready access to faculty and lab facilities for research.

Mission Statement

The Department of Electrical Engineering supports the mission of the College of Engineering and of Lamar University through teaching, research and service designed to provide the very best undergraduate electrical engineering education possible. It is our goal to provide our students with a strong theoretical foundation, practical engineering skills, experience in interpersonal communication and teamwork, and a daily emphasis on ethics, professional conduct and critical thinking. We prepare our graduates for successful engagement in commercial and industrial enterprise, research and development, and graduate study. We emphasize and support the training necessary for practice as professional engineers. Our program supports and encourages advanced study and undergraduate research activities and maintains an active research and teaching program at the graduate level through the doctorate.

Educational Objectives of the Electrical Engineering Program

- To prepare our students for successful and productive engineering careers, with emphasis on technical competency and with attention to teamwork and effective communication.
- To prepare our students for the successful pursuit of graduate studies and for life-long learning in electrical engineering and related fields.
- To endow our students with a sense of professionalism with encouragement of professional ethics, professional licensing, and active participation in the affairs of the profession.

Program Outcomes of the Electrical Engineering Program

The educational outcomes that our students can expect to derive from the electrical engineering program are the following:

- *apply* knowledge of the physical sciences, mathematics, and engineering fundamentals to the solution of electrical engineering problems.
- *design* and *conduct experiments* in electrical engineering and analyze and interpret the data generated by those experiments.
- *design* components, devices, and systems to meet specific needs in electrical engineering.
- *work effectively* on multi-disciplinary teams involving people from diverse backgrounds.
- *identify and define problems* in electrical engineering and generate and evaluate solutions to those problems.
- *understand* the professional and ethical responsibilities incumbent upon the practicing electrical engineer.
- *communicate effectively*, both verbally and in writing.
- *understand* the role and impact of electrical engineering in a broader societal and global context.
- *recognize and respond* to the need for life-long learning for a successful career in electrical engineering.
- *develop an understanding* of contemporary technical and professional issues in the practice of electrical engineering.
- *use* the techniques, skills, and tools of modern engineering, including computer-based technologies such as programming, engineering and business applications, and the use of electronic media effectively in the practice of electrical engineering.-

Upon admission to the electrical engineering program, the student will be advised by the faculty of the department. Students are encouraged to seek out advice and counseling during any stage of their education. The faculty's greatest satisfaction is the success of its students.

Students entering the electrical engineering program must have a high school course in procedural and/or object-oriented programming. If not, they must take ELEN 1301 or COSC 1336 and COSC 1337 prior to admission to advanced status.

The Department of Electrical Engineering will permit transfer of up to 66 semester hours of appropriate courses from a junior college or a community college. If the necessary pre-engineering requirements are satisfied, transfer students may finish their degree in four or five semesters.

Bachelor of Science – Electrical Engineering

Suggested Program of Study – Total Min. Hours: 128

First Year

Fall Semester		Spring Semester	
ENGL 1301 Composition I	3	ENGL 1302/1374 Composition II	3
MATH 2413 Calculus & Analytic Geo I	4	MATH 2414 Calculus & Analytic Geo II	4
ELEN 1100 Intro to Elec Engr	2	PHYS 2425 Mechanics & Heat	4
CHEM 1411 Chemistry I	4	Social Science Elective[SS]	3
PHIL 1370 Philosophy of Knowledge	3		
PEGA Physical Education	1		
	15		15

Second Year

MATH 2415 Calculus & Analytic Geo III	4	MATH 3301 Ordinary Diff Equations	3
MATH 2318 Linear Algebra	3	PHYS Modern Physics	3
PHYS 2426 Heat, Elctricity & Magnetism	4	ELEN 2311 Circuits I	3
MATH 3371 Electromagnetics	3	ELEN 2107 Circuits Lab	1
INEN 2273 Engineering Economics	2	History Elective[HI]	3
		Foreign Lang./Comm. Elective[CO]	3
	16		16

Third Year

ELEN 3108 Electronics Lab	1	ELEN 3313 Signals and Systems	1
ELEN 3312 Circuits II	3	ELEN 3322 Electronics II	3
ELEN 3321 Electronics I	3	ELEN 3381 Electrical Analysis	3
ELEN 3371 Electromagnetics	3	ELEN 3441 Fund Power Engr	4
ELEN 3431 Digital Logic Design	4	History Elective[HI]	3
ENGL Literature	3		
	17		14

Fourth Year

ELEN 4101 Seminar I	1	ELEN 4102 Seminar II	1
ELEN 4206 Senior Projects Design I	2	ELEN 4207 Senior Projects Design II	2
ELEN 4351 Control Engineering	3	ELEN 4387 Microcomputers II	3
ELEN 4486 Microcomputer I	4	ELEN Elective[EE]	3
ELEN Elective[EE]	3	POLS 2302 American Government II	3
POLS 2301 American Government I	3	Fine Arts Elective[FA]	3
	16		15

Notes:
(EE) Math and Science courses may be substituted if approved by the department chair.
(SS) Social Science electives are: ECON 1301, PSYC 2301, ANTH 2346 or 2351, SOCI 1301, or (both ECON 2301 & ECON 2302)
(CO) Communication electives are: COMM 1315, 1360, 2335, 2373, 3310, or 3340 or introductory modern language course including CMDS 2375
(FA) Fine Arts electives are: ARTS 1301, DANC 2304, HUMA 1315, MUSI 1306, or THEA 1310
(HI) Two semesters of US or Texas history from HIST 1301, 1302, 2372, 2374, 1361, 1362, 2377, 2301.

Electrical Engineering Courses (ELEN)

1100 Introduction to Electrical Engineering **1:0:3**
A survey of electrical engineering principles and introduction to the design process with emphasis on signal processing hardware and software.

1301 Introduction to Computers and Programming **3:3:0**
Digital computers, program organization, algorithm development using engineering examples and high-level languages.
Pre or Corequisite: MATH 2413.

2107 Circuits Laboratory **1:0:3**
Experience in the use of elementary electrical equipment and elements, including the oscilloscope. One-half hour design content.
Corequisite: ELEN 2311.

2300 Analog/Digital Circuits and Logic **3:2.5:1**
For non-EE majors, this course covers a broad range of analog and digital electrical engineering topics. Although primarily intended for CS majors, may be taken by qualified students from other majors.
Prerequisite: MATH 2413 or equivalent.

2310 Fundamentals of Electrical Engineering **3:3:0**
For non-EE majors, this course covers the three areas of circuits, electronics and power. Topics include dc and ac circuit analysis; electronic components and ciruits; and power calculations for dc, ac single and three-phase loads, and electric machines.
Prerequisite: MATH 2414, PHYS 2426.

2311 Circuits I **3:3:0**
Linear network analysis. Fundamental network laws and methods. Transient response. Sinusoidal steady state analysis and response.
Prerequisites: MATH 2414, PHYS 2426.

3108 Electronics Laboratory **1:0:3**
Design of power supplies and amplifiers using diodes, transistors, thysistors and linear integrated circuits.
Prerequisite: ELEN 2107.
Corequisite: ELEN 3321.

3312 Circuits II **3:3:0**
Power calculations, polyphase circuits. Frequency response, resonance, magnetically coupled circuits, two port networks. Fourier series, Fourier and Laplace transform application.
Prerequisite: ELEN 2311, MATH 2318, 3301.

3313 Signals and Systems **3:3:0**
Circuit design concepts using frequency domain. Pole-zero characterization of system response. Synthesis of passive and active networks. Two hours design content.
Prerequisite: ELEN 3312.

3321 Electronics I **3:3:0**
Design and analysis of circuits using diodes, transistors, and linear and digital integrated circuits. One hour design content.
Prerequisite: ELEN 2311.

3322 Electronics II **3:3:0**
In depth study of semiconductor devices and integrated circuit characteristics, stability, feedback amplifiers and frequency response. One and a half hours design content.
Prerequisite: ELEN 3321, 3312

3371 Electromagnetics I **3:3:0**
Vector analysis, coordinate systems, static and quasi-static electric fields, electric potential, dielectrics, capacitance, current, conductance, magnetic vector potential, electromagnetic forces. Maxwell's Equations, plane waves, transmission lines and Smith chart analysis.
Prerequisite: MATH 2318, 3301, PHYS 2426, ELEN 2311.

3381 Electrical Analysis **3:3:0**
Application of the digital computer to analysis and design of electrical systems using numerical methods. One hour design content.
Prerequisite: MATH 2318, 3301, ELEN 2311 and 1301 or equivalent.

3431 Digital Logic Design **4:3:2**
Switching algebra. Formulate and manipulate switching functions. Combinational networks. Flip-flops. Sequential networks. One hour design content.
Prerequisite: Junior standing.

3441 Fundamentals of Power Engineering **4:3:3**
Review of three phase circuit analysis. Principles of electromechanical energy conversion, operation of transformers, DC machines, synchronous machines, induction machines and fractional horsepower machines. Introduction to electronic motor drives, power electronics and power network models. The per unit system. Newton-Raphson power flow. Symmetrical three phase faults. The laboratory includes the operation, analysis and performance of transformers, motors and generators.
Corequisites: ELEN 3313, ELEN 3322.

4101 Electrical Engineering Seminar I **1:1:0**
A study of the literature of electrical and related engineering fields; preparation and presentation of papers on electrical subjects.
Pre or Corequisite: ELEN 4206 or 4207.

4102 Electrical Engineering Seminar II **1:1:0**
Preparation, presentation and discussion of material on the engineering profession, the interface between technology and society, and new areas of engineering involvement.
Pre or Corequisite: ELEN 4206 or 4207.

4206 Senior Projects Design I **2:1:5**
Senior design projects with hardware implementation and testing. Preparation of project proposals, formal report and presentation. Two hours design content.
Prerequisite: ELEN 3313, 3322, 3441, 3381, 3431.

4207 Senior Projects Design II **2:1:5**
Senior design projects with hardware implementation and testing. Preparation of project proposals, formal report and presentation. Two hours design content.
Prerequisite: ELEN 3313, 3322, 3441, 3381, 3431.

4304 Advanced Topics **3:3:0**
Topics are selected on the basis of the needs of an adequate number of students. May be repeated for credit when topics vary. Topics include artificial neural networks, digital signal processing, advanced electromagnetics, fault tolerant design, fiber optics, advanced power systems, and VLSI (very large scale integrated circuit) design.
Prerequisite: ELEN 3312, 3322.

4342 Electric Power Systems **3:3:0**
An introduction to electric power system analysis. Transmission line calculations, system operation, short circuit computations. One hour design content.
Prerequisite: ELEN 3441, 3371.

4351 Control Engineering **3:3:0**
Transfer functions, stability criteria, time response, frequency response, root locus, design, and compensation. One hour design content.
Prerequisite: ELEN 3313.

4361 Introduction to Communication Theory **3:3:0**
Principles of modulation, random signal theory and network analysis, basic information theory, analysis of noise. One hour design content.
Prerequisite: ELEN 3312, 3321

4372 Electromagnetics II Topics **3:3:0**
Intermediate-level electromagnetics topics. May be repeated for credit when topics vary. Topics may include fiber optic wave guides and systems, communication antennas, microwave circuits and systems, radar theory and applications, etc. One and a half hours design content.
Prerequisite: ELEN 3371

4381 Instrumentation **3:3:0**
Unified methods for the design of signal conditioning circuits between sensors and computers. Accepted practice for sensor based microprocessor and microcomputer data acquisition and processing systems. Instrumentation amplifier circuits. Two hours design content.
Prerequisite: ELEN 3321, 3431.

4486 Microcomputer I **4:3:2**
Introduction to assembly language programming, microcomputer architecture, and operating systems. One and a half hours design content.
Prerequisite: ELEN 3431.

4387 Microcomputer II **3:2.5:1**
Advanced assembly language, microcomputer organization, interfacing with peripheral devices and computer software development systems. One and a half hours design content.
Prerequisite: ELEN 4486.

Department of Industrial Engineering

The Bachelor of Science in Industrial Engineering program is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology.

Department Chair: Victor Zaloom **2014 Cherry Building, Phone 880-8804**

Professors: Zaloom, Chu

Associate Professors: Craig**,** Underdown

Assistant Professor: Curry, Liu, Marquez, Zhu

Adjunct Faculty: Kim

Laboratory Technician: Costa

Administrative Associate: Craigen

Degrees Offered

The Department of Industrial Engineering offers Bachelor of Science degrees in Industrial Engineering and in Industrial Technology.

Industrial Engineering

Industrial engineering serves vital functions in today's world and provides a wide range of career opportunities. It is particularly well positioned to develop individuals who provide solutions for the fields of supply chain management, logistics, operations research, project management, six sigma, economic analysis and associated solutions, quality assurance management, plant operation control/design and managerial problem solving that require a knowledge of fundamental science and engineering practices including human-system interaction.

Industrial engineering deals not only with technology but also with people. It especially deals with managerial problems requiring knowledge of fundamental science and engineering practice for their solutions. The Department of Industrial Engineering at Lamar University is one of the leaders in integrating computer applications including computer integrated manufacturing, simulation, lean manufacturing and micro-meso machining into the curriculum.

Industrial engineers combine advanced study in management systems, economics and decision-making to answer such questions as: "What products or services should we offer? What materials and methods should we use? How can we best motivate and reward people? How can we improve quality, productivity, service, and employee safety?"

Typical responsibilities of the industrial engineer involve design, operation and management. While manufacturing industry demands many graduates, increasing numbers are finding satisfying employment in other kinds of businesses. Airlines, banks, restaurant chains, department stores, hospitals, and governmental agencies.

An advisory committee of successful alumni from industry supports the department's academic staff. The Lamar University Industrial Engineering Department provides a campus home and friendly team atmosphere with a focus on preparation of students for career leadership.

Mission Statement

Our mission is to provide quality education and meaningful career opportunities for both undergraduate and graduate students. We develop highly qualified graduates with potential to assume positions of increasing responsibility.

Our mission will be accomplished by recruiting and educating qualified students in an accredited curriculum of academic course work and experiences. Demand for graduates will be driven by frequent contact with employers through initiatives such as advisory council meetings, continuing education, co-op programs, consultation, research/development, publications, and student projects.

Our Vision

Our vision is to be the "Preferred Provider of Industrial Engineering Graduates and Technology." We will accomplish our vision by: (1) recruiting quality students, (2) developing employer-focused relationships (3) increasing supporting resources, and (4) integrating academic course work and industrial engineering experiences.

Industrial Engineering Department Goals

1. Recruit high-quality industrial engineering students
2. Prepare students with skills to compete through course work in an accredited program
3. Enhance students' career opportunities through frequent employer contacts and work experiences
4. Encourage students to develop leadership skills
5. Encourage students to pursue life-long learning
6. Develop relationships with employers of industrial engineering skills
7. Increase department resources through growth in enrollment, development, and funded projects
8. Conduct applied research and publish results with the ultimate goal of technology transfer for the betterment of mankind
9. Provide exemplary service for the benefit of the University, the Beaumont metropolitan community, the State of Texas, local and global business and industrial organizations, and the engineering profession

Industrial Engineering Program Objectives

Graduates of the BSIE program are expected to be able to practice the following:

1. Graduates will possess the ability to design, redesign, develop, implement and improve complex integrated systems with an appreciation of professional and ethical responsibility.
2. Graduates will have the ability to apply the principles and techniques of tadditional and modern quantitative and qualitative analysis and synthesis and effectively interpret, evaluate, select and communicate the desired alternative in both manufacturing and service industries.
3. Graduates will possess the required industrial engineering competence and the ability to recognize the need for life-long learning to understand the impact of engineering solutions on society at all levels of an organization.

4. Graduates will demonstrate the ability to identify, formulate and solve industrial engineering problems and apply continuous improvement in practice both individually and as members and/or leaders of multidisciplinary teams.

Industrial Engineering Program Outcomes

The following outcomes are achieved in one or more courses in the BSIE curriculum. Graduates will have the following:

1. an ability to apply knowledge of mathematics, science and engineering.
2. an ability to design and conduct experiments, as well as to analyze and interpret data.
3. an ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical health and safety, manufacturability and sustainability.
4. an ability to function on multidisciplinary teams.
5. an ability to identify, formulate and solve engineering problems.
6. an understanding of professional and ethical responsibility.
7. an ability to communication effectively.
8. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context.
9. a recognition of the need for and ability to to engage in life-long learning.
10. a knowledge of contemporary issues.
11. an ability to use the techniques, skills and modern engineering tools necessary for engineering practice.
12. an ability to design, develop, implement and improve systems that include people, materials, information, equipment and energy.
13. the in-depth instruction to accomplish the integration of systems using appropriate analytical, computational and experimental practices.

Bachelor of Science – Industrial Engineering

Suggested Program of Study – Total Min. Hours: 130

First Year

Fall Semester		Spring Semester	
INEN 1101 Intro to Engineering	1	INEN 2360 Comp. Appl. In IE	3
CHEM 1411 Chemistry I	4	ELEN 1301 Intro to Computers	3
ENGL 1301 English Composition I	3	ENGL 1302/1374 English Composition	3
MATH 2413 Calculus & Anal Geom I	4	MATH 2414 Calculus & Analalytic Geo. II	4
PHIL 1370 Philosophy of Knowledge	3	PHYS 2425 Physics I	4
PEGA	1		
	16		17

Second Year

INEN 2273 Engineering Economics	2	INEN 3380 Work Design	3
INEN 3320 Probability & Stat for Engr	3	INEN 4320 Stat Decision Making for Engr	3
CVEN 2301 Statics	3	ELEN 2310 Fund Electrical Engr	3
MATH 2318 Linear Algebra	3	MATH 3301 Diff. Eq.	3
PHYS 2426 Physics II	4	MEEN 2302 Dynamics	3
	15		15

Third Year

INEN 3322 Engr. Matls. & Procs.	3	INEN 4316 Industrial and Product Safety	3
INEN 4315 Industrial Management	3	INEN 4345 Computer Int. Manufacturing	3
INEN 4350 Production & Inventory Control	3	INEN 4370 Operations Research	3
INEN 4300 Quality Improvement	3	CHEM 1412 - Lab Science Elective (1)	4
ECON 1301 Social Science Elective (2)	3	HIST (1301-2377) History II	3
HIST 1301-1377 History I	3		
	18		16

Fourth Year

ENGL 2322-2377 English Literature	3	INEN 4385 IE Design	3
INEN 4312 IE Systems Design	3	INEN/TECH Elective (3)	3
INEN 4375 Simulation of IE Sys.	3	INEN/TECH Elective (3)	3
INEN/TECH Elective (3)	3	Fine Arts Elective (6)	3
POLS 2301 American Gov't. I	3	POLS 2302 American Gov't. II	3
COMM 1315, 1360, 2335, 2373, 3310, 3340 (4)	3		
	18		15

Notes:
(1) CHEM 1412 or another course approved by the INEN advisor.
(2) Social science electives are ECON 1301, PSYC 2301, SOCI 1301, ANTH 2346 or (ECON 2301 and ECON 2302).
(3) A 3000- or 4000-level INEN course approved by INEN advisor.
(4) COMM 1315, 1360, 2335, 2373, 3310, 3340, or Modern Language including DSDE 2375 American Sign Language.
(5) Any course in Sophomore Literature (ENGL 2322-2377) will satisfy this requirement.
(6) Fine arts electives are: ARTS 1301, DANC 2304, HUMA 1315, MUSI 1306 or THEA 1310.

Bachelor of Science/MBA (five-year program)

Industrial Engineering undergraduates are eligible to participate in a five-year academic program that leads to two degrees: a Bachelor of Science in Industrial Engineering and Masters of Business Administration (MBA).

Industrial Engineering students will complete all of the normal Bachelor of Science in Industrial Engineering degree requirements and the Industrial Engineering electives are replaced with MBA leveling courses. Economics is taken as the social science.

Special scholarships are available to qualified high school graduates. An expedited MBA admission process is also available to Bachelor of Science in Industrial Engineering seniors who meet requirements.

Industrial Technology

The Department of Industrial Engineering offers a Bachelor of Science degree in Industrial Technology (BSIT). Lamar University's Industrial Technology program prepares students for positions in industrial management. The BSIT allows students to transfer up to 40 hours of technical coursework. The BSIT provides students with the credentials for promotion within their technical field or for a career in Industrial Technology.

Students will learn how to streamline processes, improve quality, ensure safety in the workplace, and manage production and inventory systems and technical personnel. Industrial Technology students typically gain employment with companies that manufacture a product. Daily activities might include solving problems in production, improving quality of products and processes and managing technical personnel.

The first two years of this program are composed primarily of technical courses commonly taken at two-year schools such as the Lamar Institute of Technology, Lamar State College at Orange or Lamar State College at Port Arthur. Students are also accepted from other technical two-year programs throughout the state and nation.

Admission to the Industrial Technology program will be granted upon application, after completion of a minimum of 40 semester hours toward the Associate of Applied Science degree or Engineering common program with a grade point average of at least 2.00. Students in a two-year applied science program who intend to continue their education in the Industrial Technology program should make an appointment for advisement very early in their coursework. Early advisement for the BSIT will ensure that courses taken during the applied science program will transfer to the Industrial Technology program.

Bachelor of Science in Industrial Technology – Information Technology (BSIT-IT)

Lamar University's Bachelor of Science in Industrial Technology program with a minor in Information Technology (BSIT-IT) prepares students for technical positions that require a working knowledge of computers and process improvement techniques. The BSIT-IT allows 27 hours technical hours to transfer and requires 21 hours in Management Information Systems to secure the minor. Students will learn the content of the BSIT program and will be prepared for similar career opportunities.

Industrial Technology Program Educational Objectives

1. Graduates will possess the ability to develop, implement and improve integrated systems that include people, materials, information, equipment and energy.
2. Graduates will possess the ability to solve technical problems, to work on multidisciplinary teams, and to communicate problems and solutions effectively in both the manufacturing and service industries.
3. Graduates will possess an appreciation of professional and ethical responsibility and the desire to seek self-improvement.

Industrial Technology Program Outcomes

1. An ability to apply knowledge of mathematics and science to the analysis of industrial technology problems
2. An ability to conduct scientific and technical experiments, as well as to analyze and interpret data
3. An ability to improve a system, component or process to meet desired needs
4. An ability to function on multidisciplinary teams
5. An ability to identify, formulate and solve technical problems
6. An understanding of professional and ethical responsibility
7. An ability to communicate effectively
8. A broad education necessary to understand the impact of technical solutions on a society both locally and globally
9. A recognition of the need for and ability to engage in life-long learning
10. A knowledge of contemporary issues
11. An ability to use the techniques, skills and modern technical tools necessary for industrial technology practice
12. An ability to develop, implement and improve systems that include people, materials, information, equipment and energy
13. The in depth instruction to integrate systems using appropriate analytical, computational and experimental practices

Bachelor of Science – Industrial Technology

Suggested Program of Study – Total Min. Hours: 120

First Year

First Semester		Second Semester	
Technology Courses	9	Technology Courses	9
Engl Comp I	3	Engl Comp II	3
COMM/Mod Lang (1)	3	MATH 1314	3
	15		15

Second Year

Technology Courses	9	Technology Courses	12
INEN 3300 Intro to IE	3	Elective: Social Science (2)	3
PEGA	1		
	13		15

Third Year

MATH 1342 (7)*	3	INEN 2360 Computer Apps in IE	3
INEN Elective (5)	3	INEN 3380 Work Design	3
PHIL 1370 Philosophy of Knowledge	3	English Lit (4)	3
Lab Science 1	4	Lab Science 2	4
History 1 (3)	3	History 2 (3)	3
	16		16

Fourth Year

INEN 3330 Engineering Economy	3	INEN 4301 Quality Control Apps	3
INEN Elective (5)	3	INEN 4351 Prod. and Invent. Sys.	3
INEN 4315 Industrial Mgmt	3	INEN 4316 Industrial and Product Safety	3
INEN Elective (5)	3	Elective: Fine Arts (6)	3
POLS 2301 American Govt I	3	POLS 2302 American Govt II	3
	15		15

Notes:
(1) COMM 1315, 1360 (hon.), 2335, 3310, 3340, DSDE 2375 (American Sign Language) or Modern Language.
(2) Social science electives are ECON 1301, PSYC 2301, SOCI 1301, ANTH 2346 or (ECON 2301 and ECON 2302).
(3) Select from HIST 1301, 1302, 1361 (hon.), 1362 (hon.), 2373, 2374, 2377.
(4) Any course in Sophomore Literature (ENGL 2322-2377) will satisfy this requirement.
(5) A 3000- or 4000-level INEN course approved by INEN advisor.
(6) Fine arts electives are: ARTS 1301, DANC 1370, HUMA 1315, MUSI 1306 or THEA 1310.
(7) or MATH 1325, 2318.

Industrial Engineering Courses (INEN)

1101 Introduction to Engineering **1:1:0**
Students are introduced to five engineering disciplines: chemical, civil, electrical, industrial and mechanical. Student services such as the Career Center, Engineering Advisory Center and Engineering Cooperative Education Center are introduced. Study skills and strategies for a successful freshman year are discussed.

2273 Engineering Economics **2:3:0**
The time value of economic resources, engineering project investment anaysis, effect of taxes on engineering project decisions.
Prerequisite: MATH 2413

2301 Applications of Quantitative Methods **3:3:0**
Introduction and applications of differential calculus, probability and statistics, and linear algebra.
Not open to students majoring in engineering
Prerequisite: MATH 1314

2360 Computer Applications in Industrial Engineering 3:3:0
Problems in application areas such as operations research, production planning and scheduling, quality and inventory control will be presented. Software packages will be used as aids to solve problems normally encountered by industrial engineers.

3300 Industrial Engineering 3:3:0
Introduction to Industrial Engineering, its tools and techniques. Not open to students majoring in engineering.

3320 Probability and Statistics for Engineering 3:3:0
Probability definitions, sample spaces, condition probability, Bayes's Theorem, independence, random variables, discrete and continuous distributions, expectation and variance, and testing hypotheses.
Prerequisite: MATH 2413

3322 Engineering Materials and Processes 3:2:3
Basic principles underlying the behavior of engineering materials, methods and processes. Machine tool process planning and operation, safety, quality and economics. Introduction to digital programming of machine tools and robots.

3330 Engineering Economy 3:3:0
Economics applied to the evaluation of engineering proposals. The effects of depreciation, taxation and interest rates.
Not open to students majoring in engineering.
Prerequisite: MATH 1314 and INEN 2301

3380 Work Design 3:2:3
Determination of work content, layout, methods, and times required for manufacturing tasks. Design of jobs and workplace for productivity and human value content.
Prerequisites: INEN 3320 or 2301

4300 Quality Improvement 3:3:0
Statistical methods and other industrial engineering analysis and design tools are used to control and improve quality and assure requirements are met.
Prerequisite: INEN 3320

4301 Quality Control Applications 3:3:0
Quality assurance and the application of statistics to the control of quality. Control charts, acceptance sampling reliability and the role of standards in the quality function.
Not open to students majoring in engineering.

4312 IE Systems Design 3:3:0
Prepares and guides students through a real-world industrial problem. Topics include: project/client management, process improvement, engineering design and social impacts of engineering solutions. Students design systems to solve problems or problems typical of those encountered by practicing industrial engineers. Students work in teams in formulate issues, collect data, analyze data, design solutions, and communicate design solutions in formal and written presentations.
Prerequisites: INEN 3322, INEN 3380.
Corequisite: INEN 4375.

4315 Industrial Management 3:3:0
Provides a foundation for becoming a manager in an industrial organization. Topics include: leadership, strategic planning, culture change, human resources and ethics.
Prerequisite: Junior standing

4316 Industrial and Product Safety 3:3:0
Loss control engineering. Mandatory and voluntary standards. Product liability.
Prerequisite: Senior standing and INEN 3380.

4320 Statistical Decision Making for Engineers 3:3:0
Analysis of data to help the engineer/executive make decisions. Evaluations of performance claims.
Prerequisite: INEN 3320.

4345 Computer Integrated Manufacturing (CIM) 3:3:0
Study of computer aided design and computer aided manufacturing to include geometric modeling in a 3D solids environment, analysis of engineering design problems, computer numerical control (CNC), and manufacturing control systems.
Prerequisite: INEN 3322

4350 Production and Inventory Control 3:3:0
Techniques for planning and controlling production and inventories. Modern materials requirements planning.
Prerequisite: Junior standing

4351 Production and Inventory Systems 3:3:0
The design and operation of systems for managing production and inventories.
Not open to students majoring in engineering.
Prerequisite: INEN 3301 or INEN 3300

4354* Lean Manufacturing 3:3:0
The planning, evaluation, deployment and integration of lean manufacturing theory and methods. Emphasis on manufacturing processes/equipment and systems.
Prerequisite: INEN 3380

4363* Six Sigma **3:3:0**
Overview of the six sigma DMAIC methodology at the green belt level of competency with emphasis on process management.
Prerequisite: INEN 3380

4369 Engineering Management **3:3:0**
Transition from engineering to management decision-making responsibilities. Topics include: leadership, proposal writing, negotiation, process/project management, and technology management.
Prerequisite: Senior standing

4370 Operations Research **3:3:0**
An introduction to the construction and mathematical models of organizational systems to aid executives in making decisions.
Prerequisite: MATH 2318

4374 Human Factors Engineering **3:3:0**
Convey human linear programming and stochastic models with a focus on formulation and solution procedure.
Prerequisite: INEN 3380

4375 Simulation of I.E. Systems **3:3:0**
Introduction to concepts of simulation modeling and analysis with application to manufacturing and service systems. Students will apply problem solving and process analysis techniques to an industrial engineering problem and propose an improved systems design.
Prerequisite: INEN 4320

4376 Occupational Ergonomics **3:3:0**
Application of ergonomics to the design and/or redesign of jobs, manufacturing workstations, and other work environments to achieve increased profitability and reductions in injury/illness.
Prerequisite: INEN 3380

4379 Facilities Design
Study of concepts and methods used to design an effective facility layout and materials-handling system.
Prerequisite: Senior standing

4381 Heuristic Algorithms **3:3:0**
Heuristic Algorithms and applications to classical and real life problems. Justification and logic of heuristic algorithms. Greedy algorithms, Steepest Ascent, Numerical optimization, Simulated Annealing, Taboo Search, Cross entropy optimization. TSP, Set covering, Set partitioning.
Prerequisite: INEN 4370, INEN 2360

4382* Data Mining **3:3:0**
An introduction to data mining that covers data warehousing, data cleaning, data cubes, classification algorithms, clustering, and advanced regression techniques.
Prerequisite: Junior standing

4385 I.E. Design **3:3:0**
Prepares and guides students through a real-world industrial problem. Students design systems to solve problems or problems typical of those encountered by practicing industrial engineers. Students work in teams to formulate issues, collect data, analyze data, design solutions, and communicate design solutions in formal and written presentations.
Prerequisites: INEN 4312, INEN 4375

4392 Virtual Reality and Haptics **3:3:0**
This is an introduction to virtual reality research course, which focuses on the emerging interdisciplinary field of virtual reality and haptic technology. Haptics is a research technology that will revolutionize all aspects of Information Technology as well as impacting in the general area of human machine interface design. The course will discuss the virtual reality architecture, the haptic (touch) software and hardware, and the virtual reality applications in design and manufacturing, medical simulation, education and training, etc. Prerequisite: C/C++ programming required, Graphics programming experience preferred but not required (will cover the graphic basics in the course). A complementary course 'Computational Methods' is offered to provide training on C++ programming and Computer Graphics.

4394 Engineering Database Design **3:3:0**
To provide students in engineering with knowledge about the design and implementation of engineering applications using database technology. Examples will be drawn from manufacturing and production systems. Prerequisite: It is assumed that students have had a programming course and are familiar with fundamental programming constructs.

4395* Computational Methods **3:3:0**
This course introduces students to numeric research. Major topics covered are C++, LP/IP software application development, and Computer Graphics.
Prerequisite: Any introductory programming course

4396 Automated Systems Engineering **3:3:0**
To provide students in engineering with knowledge about the industrial automation and process control in the manufacturing industry: control system, PLC, sensor and actuator, auto-id, flexible manufacturing system, assembly line and automatic inspection
Prerequisite: Senior with good standing or Graduate students, or permission of instructor

** Pending approval by the Texas Higher Education Coordinating Board*

Department of Mechanical Engineering

Program accredited by the Engineering Accreditation Commission of the Accreditation Board of Engineering and Technology.

Department Chair: Hsing-wei Chu **2008 Cherry Building, Phone 880-8769**

Professors: Chu Corder, Srinivasan

Associate Professor: Aung, Fan

Assistant Professor: Li, Zhou

Laboratory Technician: Day

Administrative Associate: Venable

Mission Statement

The mission of the Department of Mechanical Engineering at Lamar University is to provide high-quality educational and meaningful career opportunities for its graduates, so they may assume professional positions of increasing responsibility. Recruiting and educating students in an accredited curriculum of course work and experiences reflects the department's mission. Demand for graduates of the department will be enhanced by frequent contact with potential employers through initiatives such as co-op programs, consultations, research and development, and student projects. Frequent program assessment ensures that students' and employers' needs drive the continual refinement of curricula and departmental objectives.

Vision

The vision of the mechanical engineering department at Lamar University is to be a leader in training students for the mechanical engineering profession. The mechanical engineer may be perceived as one who is engaged in a diverse profession encompassing the analysis, design, synthesis and material optimization for a wide variety of mechanical and thermal systems. The mechanical engineer must work closely with other engineering disciplines to provide tools and equipment components to enable them to practice their professions. In order to cover this wide range of requirements, the mechanical engineer needs a solid foundation in basic sciences, mathematical sciences and engineering.

Mechanical Engineering Program Educational Objectives

As defined by American Society of Mechanical Engineers (ASME) International, mechanical engineers are men and women who design, develop and manufacture machines that produce, transmit or use power. There is hardly an area in modern life that has not been influenced by a mechanical engineer at some point along the path from invention to installation. Mechanical engineering knowledge is essential to build automobiles, airplanes, ships, satellites and health care equipment, to name a few.

Mechanical engineering occupies this unique position as it effectively utilizes basic sciences, mathematical sciences and engineering science and technology.

The major goal of the Department of Mechanical Engineering of Lamar University is to prepare undergraduate students for challenging and rewarding careers in the mechanical engineering profession. For this purpose, the mechanical engineering program is designed to educate students in the thermal systems and mechanical systems areas. The teaching focus is on basic and mathematical sciences in the freshman and sophomore years, and on engineering sciences in the junior year. In the senior year, the students are educated to develop skills to use the knowledge gained in the sophomore through junior years in mechanical engineering applications.

Keeping in view the above considerations, the faculty, in consultation with the mechanical engineering advisory council, has established the following educational objectives; these are consistent with and supportive of the Lamar University College of Engineering educational objectives and prepare mechanical engineering students to solve problems ethically and economically by

1. pursuing a career in engineering and/or graduate study;
2. demonstrating excellent technical capabilities in their chosen field;
3. continuing to learn while growing the profession, using modern technology and communication skills;
4. contributing as a team member or leader in solving problems for their employer and for society;
5. participating in professional activities; and
6. understanding the broad safety, environmental, ethical and economic consequences of their work.

Mechanical Engineering Program Outcomes

The purpose of the mechanical engineering program of Lamar University is to ensure that the graduates have:

(a) an ability to apply knowledge of mathematics, science and engineering;
(b) an ability to design and conduct experiments, as well as to analyze and interpret data;
(c) an ability to design a system, component or process to meet desired needs;
(d) an ability to identify, formulate and solve engineering problems;
(e) an understanding of professional and ethical responsibility;
(f) an ability to communicate effectively;
(g) the broad education necessary to understand the impact of engineering solutions in a global and societal context;
(h) a recognition of the need for, and an ability to engage in, life-long learning;
(i) a knowledge of contemporary issues;
(j) an ability to use the techniques, skills and modern engineering tools for engineering practice;
(k) a knowledge of chemistry and calculus-based physics with depth in at least one
(l) an ability to apply advanced mathematics through multivariate calculus and differential equations;
(m) an ability to use statistics and linear algebra;
(n) an ability to work professionally in both thermal and mechanical systems areas including the design and realization of such systems;
(o) an ability to work effectively as team members in mechanical engineering projects;

(p) a knowledge of manufacturing, maintenance and inspections for engineering systems; and

(q) an ability to function on multi-disciplinary teams.

Rubrics for quantitative measurement of attainment of these program outcomes were developed and used for outcome assessments. Based on the results of the outcome assessments, continuous program improvements are being implemented.

Bachelor of Science – Mechanical Engineering

Suggested Program of Study – Total Min. Hours: 138

First Year

Fall Semester		Spring Semester	
ENGL 1301 Composition I	3	ENGL 1302/1374 Composition	3
MATH 2413 Calculus & Anal Geom I	4	MATH 2414 Calculus & Anal Geom II	4
CHEM 1411 Gen Chemistry	4	ELEN 1301 Intro to Computers	3
INEN 1101 Intro Engineering	1	PHYS 2425 Mechanics & Heat	4
PHIL 1370 Philosophy of Knowledge	3	History 1	3
PEGA	1		
	16		17

Second Year

MATH 2415 Calc & Anal Geom III	4	MATH 3301 Ordinary Diff Equations	3
PHYS 2426 Physics II	4	MEEN 2302 Dynamics	3
CVEN 2301 Statics	3	ELEN 2310 Fund Electrical Engr	3
MEEN 2374 Thermodynamics I	3	CVEN 2372 Mechanics of Solids	3
INEN 2273 Eng Econ	2	English Lit	3
MATH 2318 Linear Algebra	3	History (2)	2
	19		17

Third Year

First Semester		Second Semester	
MEEN 3340 Engineering Analysis	3	MEEN 3210 Measurements Lab	2
MEEN 3311 Fluid Mechanics	3	MEEN 3310 Heat Transfer	3
MEEN 3380 Thermodynamics II	3	MEEN 3300 Design of Mechanisms	3
INEN 3322 Process Engineering	3	MEEN 3320 Mech Design I	3
Elective: Fine Arts (2)	3	MEEN 3350 Intro to CAE	3
		POLS 2301 American Govt I	3
	15		17

Fourth Year

First Semester		Second Semester	
MEEN 4310 Integrated Systems Design	3	MEEN 4316 Engineering Design Project	3
MEEN 4313 Thermal Sys Des	3	MEEN 4317 Dynamic System Analysis	3
MEEN 4319 Materials Science	3	MEEN Elective	3
MEEN 4323 Mech Des II	3	Elective: Math/Science (1)	3
POLS 2302 American Govt II	3	Elective: Soc Sci (3)	3
MEEN Elective	3	Elective: Comm or Mod Lang (4)	3
MEEN 4110 Seminar	1		
	19		18

NOTES

(1) INEN 4320 or MATH 3370 or another calculus-based probability and statistics course approved by the MEEN chair.

(2) Fine Arts electives are: ARTS 1301, DANC 2304, HUMA 1315, MUSI 1306 or THEA 1310.

(3) Social Sciences electives are: ECON 1301, PSYC 2301, ANTH 2346, SOCI 1301, or ECON 2301 and ECON 2302.

(4) COMM or modern language electives are: COMM 1315, COMM 1360, COMM 2335, COMM 2373, COMM 3310, COMM 3340 or an introductory language, including CMDS 2305.

Mechanical Engineering Courses (MEEN)

2302 Dynamics **3:3:0**
Kinematics of rigid bodies, kinetics of rigid bodies, work and energy, impulse and momentum.
Prerequisite: CVEN 2301 or equivalent, MATH 2414 or concurrent.

2374* Thermodynamics I **3:3:0**
The properties of a pure substance and equations of state: The first law and second law of thermodynamics and their application in analysis of thermal process. Basic concepts of thermodynamic cycles and thermal efficiency.
Prerequisite: PHYS 2425, MATH 2415.

3210 Measurements Laboratory **2:1:3**
Theory and application of measurements with various instruments are treated. Topics include technical report writing, statistics, and data acquisition. Experiments involving pressure, temperature, speed, power, torque, frequency and flow measurements are conducted, documented and reported.
Prerequisite: MEEN 3311 and MEEN 3380.

3300 Design of Mechanisms **3:3:0**
Introduction to the concepts associated with the design of machine elements. Kinematics in the analysis of mechanisms: centroids, velocities and accelerations in plane mechanisms; rolling and sliding in belts, chains and cams; gears in plane or epicyclic trains.
Prerequisite: MEEN 2302 and CVEN 2372.

3310 Heat Transfer **3:3:0**
Theory of conduction, convection, radiation and heat transfer with engineering techniques and applications.
Prerequisite: MATH 3301. Pre or corequisite: MEEN 3311.

3311 Fluid Mechanics **3:3:0**
Fluid-flow concepts are presented through the derivation and application of the basic equations of continuity, energy and momentum. Engineering aspects of flow measurement, pressure-drop calculations and pumping requirements are considered.
Prerequisites: MEEN 2302, CHEN 2374, CVEN 2372 and MATH 3301.

3320 Mechanical Design I **3:2:3**
The design of machine components considering the design process, loads, stress, deflection and stiffness, material properties; failure theories; designing for static strength and fatigue life. A written and oral presentation of the conceptual design of a machine to meet a specified societal need is required.
Prerequisite: CVEN 2372.
Corequisite: MEEN 3350.

3340 Engineering Analysis **3:3:0**
Physical and mathematical aspects of mechanical, hydraulic, pneumatic, thermal, and electrical systems are introduced. Analysis techniques for modeling the dynamic performance of lumped mass systems are presented and applied using a unified state-space representation. Both formal analytical and extensive computer methods are utilized for the determination of model response.
Prerequisite: MATH 3301. Pre or corequisite: MEEN 3311.

3350 Computer-Aided Engineering (CAE) **3:2:3**
An overview of simulation-based design, including 3-D parametric solids models and finite element analysis, and its applications in mechanical engineering. Course focuses on the modeling aspects of mechanical systems simulation in static stress and deflection analysis.
Prerequisites: MEEN 2302, CVEN 2372.

3380 Thermodynamics II **3:3:0**
A continuation of CHEN 2374 including availability, vapor and gas cycles, mixtures of gases, thermodynamics of chemical systems and psychrometrics.
Prerequisite: MATH 3301 and CHEN 2374.

4110 Seminar **1:1:0**
Instruction in effective public speaking. Oral and written presentation and discussion of selected topics including those from current literature of fields related to mechanical engineering. Professional activities are encouraged.

4310 Integrated Systems Design **3:2:3**
The techniques of integrated systems design are treated. The student is required to utilize these techniques by performing a system design. The formation of teams is facilitated. Instruction in team dynamics is provided. Presentation of intermediate and final results by each team to the class is required followed by peer response.
Prerequisites: MEEN courses through third year and Senior standing.

4311 Energy Conversion Systems **3:3:0**
This course deals with different types of energy conversion devices and systems, including conventional heat engines, solar thermal systems, photovoltaic (PV) and future energy systems such as Stirling engines, microturbines, fuel cells, IGCC and hydrogen-based energy systems. The course also introduces the theoretical background for direct energy conversion devices such as MHD, thermoelectric and thermionic systems.

4313 Thermal Systems Design **3:3:0**
Heat transfer study with emphasis on heat exchanger design, optimization of energy exchange, economics and design feasibility. A formal oral presentation of a written report is made by the individual to the class followed by questions and answers.
Prerequisites: MEEN 3310, 3340, 3380

4316 Engineering Design Project **3:1:6**
Student research projects are planned, scheduled, designed and evaluated. Experience is gained in the execution of an engineering project and a formal technical report is required.
Prerequisite: MEEN courses through third year and senior standing.

4317 Dynamic Systems Analysis **3:3:0**
A continuation of MEEN 3340 with emphasis on simulation methods and computer techniques in solving engineering problems.
Prerequisite: MEEN 3340, MEEN 3350.

4319 Materials Science **3:2:3**
Lectures on atomic scale structures; crystal structures; point defects and diffusion; linear, planar and volume defects; noncrystalline and semicrystalline materials; introduction to phase diagrams. Laboratory experiments include tensile testing, hardness measurement, microstructure evaluation and heat treament of steel and aluminum.

4320 Mechanical Vibrations **3:3:0**
Topics in mechanical vibrations including an introduction to the theory of vibrations, mechanical vibration analysis methods including finite element modeling, mechanical vibration measurement and monitoring, interpretation of vibration measurements data and other mechanical vibration topics as appropriate.
Prerequisites: MEEN 3320, MEEN 3340.

4321* Applied Numerical Analysis **3:3:0**
Introduction to numerical techniques and their applications in different engineering problems, experimental data analysis and statistical methods, optimization methods, and numerical methods in solving differential equations.

4322* Advanced Dynamics **3:3:0**
Energy method in dynamics, free and forced vibrations, applications to systems with one-, two- and multi-degree of freedom, response to general periodic excitations, transient vibration and the phase method, vibration engineering application.

4323 Mechanical Design II **3:2:3**
Continuation of the design of machine components including the design of threaded fasteners and power screws, welded joints, mechanical springs, lubrication and sliding bearings, rolling-element bearings, spur gears, shafts, clutches and brakes, and miscellaneous power transmission components. Completion of the conceptual design begun in MEEN 3320 to include the addition of a power source, greater design detail in the elements, economic aspects of the design, and other matters as appropriate. Both a report and a presentation are required. Team formation and the use of various engineering software packages are encouraged.
Prerequisites: MEEN 3320.

4326* Control of Mechanical Systems **3:3:0**
Mathematical modeling, time response, transient and steady-state response, frequency response, root-locus, stability, control system design.

4333 IC Engines **3:3:0**
This course deals with the theory, design and simulation of internal combustion engines. The theory of internal combustion engines covers thermodynamic and fuel-air cycles, fuels and their properties, intake and exhaust flows, combustion and pollutant emissions, heat transfer and modeling of IC engines. IC engine simulation software will be used to solve practical IC engine problems. Current status and future challenges of IC engines will also be discussed.

4350 Turbomachinery **3:3:0**
Flow problems encountered in the design of water, gas and steam turbines, contrifugal and axial-flow pumps and compressors, aerothermodynamic design of gas turbines.
Prerequisite: MEEN 3311 and MEEN 3380.

4360* Introduction to Computational Fluid Dynamics (CFD) **3:3:0**
This introductory course covers the basic concepts underlying computational fluid dynamics, including derivation of governing equations, descretization, grid generation, applications of numerical methods, error reduction, and solution testing and interpretation of numerical results. Commercial CFD software packages will be used to solve practical engineering fluid dynamic problems.
Prerequisite: MEEN 3310, MEEN 3311, MEEN 3340

4361* Combustion Theory **3:3:0**
This course covers the fundamental principles of combustion theory and introduces the use of these principles in different engineering applications such as furnaces, automotive engines, gas turbines and rockets. Topics include thermochemistry, fuels, chemical kinetics, conservation equations for reacting flows, premixed and diffusion flames, droplet burning and pollutant emissions. Numerical modeling of combustion and combustion measurement techniques will be introduced.
Prerequisite: MEEN 3310, MEEN 3311, MEEN 3380

4362 Energy Engineering **3:3:0**
Different types of energy resources and their uses, different types of energy conversion technology such as fuel cells, thermoelectric, and solar energy conversion, and energy conservation technologies such as pinch technology and cogeneration, current and fture challenges of energy generation and conservation, environmental issues such as air pollution, smog and greenhouse effects, and NO_X emissions.
Prerequisite: MEEN 3310, MEEN 3311, MEEN 3380

4365* Advanced Materials Science
Phase equilibria and phase diagrams, kinetics and microstructure of structural transformations, mechanical properties and composite materials.
Prerequisite: MEEN 4319

4366* Manufacturing Analysis
Theoretical considerations in casting, bulk deformation, sheetmetal forming, polymer parts, machining and welding processes..
Prerequisite: INEN 3322

**Pending approval by the Texas Higher Education Coordinating Board*

All five undergraduate curricula in engineering—chemical, civil, electrical, industrial and mechanical—are accredited by the Engineering Accreditation Board for Engineering and Technology.

Study in the creative and communicative arts prepares students in the College of Fine Arts and Communication to become the highest-caliber professionals in their chosen careers.