

COLLEGE of ENGINEERING

Dean *Steven P. Castillo*

Associate Dean/Academic Programs *William C. McCarthy**

Associate Dean/Director of Engineering Research Center *Rudi Schoenmackers*

Assistant Dean *Patricia Sullivan*

Assistant to the Dean/Engineering Student Services *Rosemarie Melon-Sanchez*

**Registered Professional Engineer (NM)*

Bachelor of Science Chemical Engineering, Civil Engineering, Electrical Engineering, Engineering Physics, Engineering Technology, Industrial Engineering, Mechanical Engineering, Surveying Engineering

Bachelor of Information and Communication Technology

The College of Engineering comprises seven departments: Chemical Engineering; Civil Engineering; Electrical and Computer Engineering; Engineering Technology; Industrial Engineering; Mechanical Engineering; and Surveying Engineering.

Mission of the College of Engineering

The mission of the College of Engineering is to provide our various constituencies with high-quality engineering and engineering technology programs and services. Recognizing our charge as New Mexico's land-grant institution, we strive to build these programs and services on a strong foundation of academic rigor, nationally recognized applied and basic research, and effective outreach efforts.

With respect to our undergraduate programs, we will accomplish our mission by focusing on the following goals:

1. Maintaining and further developing a world-class engineering college offering high-quality and accredited education programs that prepare students for successful engineering careers in industry and government, or for further study at the graduate level.
2. Recruiting, maintaining and further developing a diverse faculty and staff skilled at teaching, research, and providing support services.
3. Maintaining and enhancing an environment that fosters creative and critical thinking, student involvement, professional and ethical awareness, life-long learning, societal awareness and a continuous improvement philosophy.
4. Building and supporting an infrastructure of appropriate laboratories, facilities, technology, and resources that enhance the College's education, research and outreach services.
5. Initiating, developing and delivering outreach programs that positively impact New Mexico's educational systems and industrial enterprises.

Furthermore, as proposed by the Accreditation Board for Engineering and Technology* (ABET) Engineering Criteria 2000, graduates receiving baccalaureate degrees in Chemical Engineering; Civil Engineering; Electrical Engineering; Industrial Engineering; Mechanical Engineering; and Surveying Engineering will demonstrate:

- an ability to apply knowledge of mathematics, science, and engineering;
- an ability to design and conduct experiments, as well as to analyze and interpret data;
- an ability to design a system, component, or process to meet desired needs;
- an ability to function on multi-disciplinary teams;
- an ability to identify, formulate, and solve engineering problems;
- an understanding of professional and ethical responsibility;

- an ability to communicate effectively;
- the broad education necessary to understand the impact of engineering solutions in a global and societal context;
- a recognition of the need for, and an ability to engage in life-long learning;
- a knowledge of contemporary issues; and
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

The Engineering Technology programs are accredited by the Technology Accreditation Commission* of ABET. Specific skills demonstrated by graduates of this program are covered in the Engineering Technology section.

Graduate Degrees

Graduate study is available in the College of Engineering. For a listing of advanced degrees, see "Graduate Programs" in the General Information chapter of this catalog, and for additional details, see the Graduate Catalog.

Student Advisement

Students coming into the College of Engineering are encouraged to declare a major and be advised by that department. At their discretion, students may change majors any time in the course of their study by notifying the associate dean for academics. However, a change in major may result in a delay in graduation.

Students uncertain about choosing a major may list themselves as undeclared in the College of Engineering and be advised by the associate dean for academics. Undeclared students will be asked to choose a major after two semesters in the college. Students must have a declared major in order to graduate.

At the discretion of the associate dean for academics, students that do not demonstrate satisfactory progress may be required to leave the College of Engineering.

Accreditation

The Accreditation Board for Engineering and Technology (ABET), established in 1933 and composed of representatives from technical societies, assures professional standards by periodic evaluations of the programs in the College of Engineering. (ABET may be contacted at 111 Market Place, Suite 1050, Baltimore, MD 21202-4012 or by phone at (410) 347-7700.)

Continuous accreditation of the various programs by the Engineering Accreditation Commission (EAC) of ABET has been in force since 1938 for civil, electrical, and mechanical engineering, 1967 for chemical engineering, 1971 for industrial engineering, 2001 for surveying engineering, and 1994 for the M.S. in environmental engineering. The electronics and computer, civil, and mechanical engineering technology associate and baccalaureate degree programs are accredited by the Technology Accreditation Commission (TAC) of ABET.

The college is a member of the American Society for Engineering Education (ASEE).

Students who desire a broader liberal education than is provided in the four-year program are encouraged to arrange with their advisers for special programs of longer duration. Students wanting to obtain strengths in other areas of academic specialization and yet remain in engineering are encouraged to do so. Specific department heads offer advisement for such dual programs.

Basic Programs

The first year of all seven Bachelor of Science degree programs in engineering are quite similar. Listing of specific courses can be found under each of the degree requirements or curricula.

Humanities and Social Sciences

As the role of the engineering graduate requires, to an ever increasing extent, a knowledge and awareness of the interaction of engineering policy and design decisions with the whole of society, an integrated group of courses in the humanities and social sciences is required of each graduate. A listing of specific courses which may be used to satisfy the humanities and social sciences requirements is available in each department. At least 18 credits of humanities and social sciences are required for the bachelors degrees. It is expected that the courses will be selected in such a manner as to provide a coherent body of study in one or more areas and to satisfy the general education requirements of the university.

S/U Coursework

The College does not allow engineering, science, mathematics, communications and technical writing coursework graded S/U to count toward the degree requirements except for those courses specifically designated in the undergraduate catalog as S/U by the departments. Qualified students may take humanities and social science courses under the S/U option.

Math Placement

Entering freshmen with an ACTM greater than 16 or transfer students without math prerequisite transfer credits are placed into the appropriate math course based upon the results of the Math Placement Exam administered regularly by the NMSU mathematics department. Students that have Advanced Placement credit for mathematics will be placed according to their AP scores but are encouraged to take the Math Placement Exam anyway to reveal areas that may require additional preparatory work. Students with an ACTM of 16 or less are placed according to the basic skills requirements of the university. At the discretion of the academic dean, math placement requirements may be altered on a case-by-case basis.

Minors

The College of Engineering offers minors in agricultural engineering, computer engineering, environmental engineering, surveying, electrical engineering, ET/manufacturing, security technology and intelligence studies, and WERC/environmental management. The surveying minor is administered by the Department of Surveying Engineering, the security technology and intelligence studies minor is administered through the Departments of Criminal Justice and Engineering Technology. The agricultural engineering and environmental engineering minors are administered by the Department of Civil Engineering. The ET/manufacturing minor is administered by the Department of Engineering Technology. The computer engineering and electrical engineering minors are administered by the Klipsch School of Electrical and Computer Engineering. Students majoring in engineering may also earn minors in other colleges.

Minor: Environmental Management (18 credits)

The environmental management minor is an interdisciplinary program administered by WERC: A Consortium for Environmental Education and Technology Development located in the Engineering Complex III building.

Requirements: A student must pass 18 credits with a grade of C or higher as outlined below. No courses may be taken S/U.

1. All students must complete the one of following (3 credits): WERC WebCT courses (classes are offered every semester and topics may vary); WERC 300, Introduction to Pollution Prevention and Its Applications; WERC 301, Introduction to Nuclear Energy Technology; WERC 350, Introduction to Energy, Environmental and Risk Assessment; WERC 425, Chemical Hygiene Awareness for New Mexico Schools; WERC 490, Special Topics.....3

2. Any two courses from the following (3 credits): WERC 330, Environmental Management Seminar I (or COE equivalent); WERC 430, Environmental Management Seminar II (or COE equivalent); WERC/ES/ET 312, Emergency Response to Hazardous Material Incidents.....3
3. Any four environmental management courses that are approved for this program (12 credits) 12

Also see www.werc.net (Degree Programs - courses that are approved for this program).

ROTC

ROTC students planning to take the advanced military courses leading to a commission as second lieutenant in the Army or the Air Force should discuss their programs with their advisers before the end of the sophomore year. The large number of required engineering courses in the junior and senior engineering programs generally make some extension necessary if ROTC is to be included. Usually taking classes during the summer between the sophomore and junior year will allow sufficient additional time.

Co-op Education

After two semesters of satisfactory academic work (2.5 GPA), an engineering student may go on a work phase with one of the many companies or governmental agencies with which the university has co-op agreements. The experience obtained through alternating periods of academic and fieldwork greatly contributes to the preparation of a student for professional life. Work phases are considered to be a vital part of the educational process, and students are counseled in the selection of co-op positions that will lead to progressive learning experiences. Earnings while on work phase provide a source of financial assistance to meet educational expenses.

A significant number of undergraduate students in engineering are in the cooperative education program. Students may enroll for 1 credit while participating in a work phase having a duration of at least 15 weeks. A total of 4 credits may be earned in this manner with the approval of the cognizant department head. Internship courses ENGR 291 and 391, designed for co-op students, are listed in the "Course Descriptions" chapter of this catalog. Internship courses do not normally count toward the degree requirements but do show on the transcript to indicate Co-op experience.

General Requirements

- 1) Students in the College of Engineering majors are expected to have a 2.0 or better cumulative grade-point average before enrolling in sophomore-level engineering courses. Additionally, the Basic Skill requirement in English and math must be satisfied before enrolling in courses numbered 300 or above.

2) I

n order to assure continuing competency, students in the College of Engineering must have completed, with a C or better grade including transfer credit, the published prerequisites for any required engineering, technology, math, or science course before being allowed to enroll in that course.

- 3) Students in the College of Engineering must earn a C or better grade in all lower-division engineering, technology, math or science courses used to satisfy degree requirements and are encouraged to repeat any course not meeting this requirement the next time the course is offered, until the student passes the course with a C or better.

NOTE: The curricula in this catalog are subject to change if the requirements of the Accreditation Board for Engineering and Technology should change.

Requirements for Graduation

The minimum requirements for undergraduate degrees are

- 1) Satisfaction of the course requirements for the various degrees as shown by the department in which the degree is offered.
- 2) Satisfaction of all other requirements for graduation as discussed in the "Regulations" section of this catalog.

In order to maintain currency and quality in the curriculum and satisfy changes in accreditation criteria, specific requirements for a given degree may be changed after publication of the Undergraduate Catalog. Any such changes will be announced and publicized.

CHEMICAL ENGINEERING

Associate Professor Martha C. Mitchell*, interim department head
Professor Richard L. Long*#, associate department head

Professors Long*#, Johnson, Munson-McGee, Patton (emeritus), Roubicek (emeritus); **Associate Professors** Andersen, Mitchell*, Rockstraw*; **Assistant Professors** Deng; **College Professor** Del Valle
 (505) 646-1214

*Registered Professional Engineer (NM)

#Registered Professional Engineer (State other than NM)

DEGREE: Bachelor of Science in Chemical Engineering

Chemical engineers combine their knowledge of science, mathematics, and physics with their expertise in engineering analysis to solve industry-level problems in both the private and public sectors. An undergraduate degree leads to an exciting career in fields such as computer chip manufacturing; environmental restoration and pollution prevention; biotechnology and bio-engineering; pharmaceutical manufacturing; food production; transportation (including automotive and aerospace); advanced materials; petrochemical and refining; chemical synthesis and production; power and energy production (including the nuclear industry); law, medicine or advanced studies at the graduate level.

In support of the mission of New Mexico State University, the Department of Chemical Engineering strives to prepare Chemical Engineering Bachelor of Science graduates to successfully and safely practice the chemical engineering profession, to engage in life-long personal and professional development, and to contribute to the betterment of their community and society.

To accomplish this mission, the department supports the objectives of the college and the university and expands the objectives to satisfy the needs of the Chemical Engineering constituent groups. The department strives to achieve the objectives of providing all graduating B.S. students with

1. a solid foundation in the fundamentals of chemical engineering science, design, and practice;
2. a sound base in chemistry, mathematics, and physics;
3. an opportunity to explore advanced disciplines pertinent to career choice;
4. an opportunity to participate on multidisciplinary teams;
5. the opportunity and training to develop the written and oral communication skills required of a practicing engineer;
6. The opportunity to develop and comprehend professional and ethical behavior, to develop an understanding of the humanities and social sciences, and to develop the skills to engage in lifelong learning.

These objectives are consistent with those of the College of Engineering and New Mexico State University in their commitment to developing student excellence in an intellectually stimulating environment, cultural diversity, and broad education programs, while encouraging individual expression, professional behavior, civic responsibility, leadership, and an appreciation for continuing education.

The NMSU curriculum meets ABET accreditation requirements.

Requirements (Total credits 135)

In addition to satisfying the requirements of the university and the College of Engineering, all majors must pass departmental classes with a grade of C or better.

Freshman Year (31 credits)

CH E 100, Introduction to Engineering.....	1
CH E 111, Introduction to Computers in Chemical Engineering.....	3
CHEM 115, 116, Principles of Chemistry I, II.....	8
COMM 265G, Principles of Human Communication.....	3
ENGL 111G, Rhetoric and Composition.....	4
MATH 191, 192, Calculus and Analytic Geometry I, II.....	6
PHYS 215, Engineering Physics I.....	3
Humanities or social science elective ¹	3

Sophomore Year (34 credits)

CH E 201, Chemical Process Calculations.....	5
CH E 301, Chemical Engineering Thermodynamics I.....	3

CH E 305, Transport Operations I: Fluid Flow.....	3
CH E 311, Engineering Data Analysis.....	3
CHEM 313, 314, 315, Organic Chemistry I, II, Lab.....	8
ENGL 218G, Technical and Scientific Communication.....	3
MATH 291, Calculus and Analytic Geometry III.....	3
MATH 392, Differential Equations.....	3
PHYS 216, Engineering Physics II.....	3

Junior Year (34 credits)

CH E 302, Chemical Engineering Thermodynamics II.....	3
CH E 306, Transport Operations II: Heat and Mass Transfer.....	3
CH E 307, Transport Operations III: Staged Operations.....	3
CH E 315L, Process Instrumentation Lab.....	2
CH E 361, Engineering Materials.....	3
CH E 407L, Transport Operations Lab.....	2
CH E 441, Chemical Kinetics and Reaction Engineering.....	3
CH E 451, Engineering Economy.....	3
CHEM 433, Physical Chemistry I.....	3
ECON 251G, Principles of Macroeconomics.....	3
Humanities or social science electives ¹	6

Senior Year (36 credits)

CH E 412, Process Control and Dynamics.....	3
CH E 422L, Unit Operations and Process Control Lab.....	2
CH E 452, Process Design, Analysis and Simulation.....	4
CH E 455, Advanced Plant Design.....	2
CH E 490, Senior Seminar.....	1
CH E upper-division elective.....	3
CHEM or natural science elective ^{2, 3}	3
CHEM elective ²	3
EE 201, Networks I.....	3
ME 236, Engineering Mechanics I.....	3
Engineering elective ⁴	3
Humanities or social sciences electives ¹	6

¹Humanities and social science electives must be selected to satisfy the university's general education requirements.

²Any upper-division chemistry class that would be acceptable for a B.S. in Chemistry that requires at least CHEM 112 as a prerequisite except for: CHEM 351, CHEM 441, CHEM 451, or CHEM 455.

³Other upper-division natural science class (such as toxicology or biology) with prior approval of your adviser.

⁴Upper-division engineering course selected with prior approval of adviser.

CIVIL ENGINEERING

Professor Kenneth R. White*, department head

Professor J. Phillip King*, associate department head

Professors Cadena-C* Hanson#, Idriss*, Jacques*, Khandan#, Samani*#, White*, Woodward*; **Assistant Professors** Bandini, Bawazir, Jauregui, McNamara, Newton, Zhang; **College Professor** Madrid*, Zellmer*#, **Adjunct Professor** Hernandez*##

(505) 646-3801

*Registered Professional Engineer (NM)

Registered Professional Engineer (State other than NM)

Registered Land Surveyor (State other than NM)

DEGREE: Bachelor of Science in Civil Engineering

- OPTION: General**
- OPTION: Structures**
- OPTION: Environmental**
- OPTION: Geotechnical**
- OPTION: Water Resources**

MINOR: Agricultural Engineering

DEGREE: Bachelor of Science in Civil Engineering

The curricula in civil engineering is designed to provide a broad background and is so arranged that students may specialize in one or more of the options listed above or work in one or more areas of civil engineering in the senior year. Students may wish to obtain more than one option in civil engineering.

Requirements

In addition to the university requirements for graduation, a student must have a 2.0 grade-point average in all departmental courses and pass the Fundamentals of Engineering Examination prior to graduation.

Civil Engineering Program Educational Objectives

Civil engineers design, test and evaluate public works projects that include structures, environmental systems, water resources, transportation and geotechnical applications. Civil engineers work as private consultants, for public agencies, industrial companies and research organizations and therefore the tools and methods of the civil engineer are both varied and broad. They use knowledge and skills in engineering, mathematics, and physical and social sciences along with the principles and methods of engineering analysis and design to evaluate and improve such systems. The undergraduate civil engineering degree program at New Mexico State University prepares students to join the work force or pursue graduate education while setting the foundation for life-long learning. Specifically, graduates of the program will be

- 1.) able to provide protection of the public health, safety and welfare;
- 2.) able to apply various civil engineering techniques in an integrated fashion to solve real-world problems through design, testing and evaluation;
- 3.) able to obtain meaningful employment or continue in a graduate program; and
- 4.) prepared for a long term successful career augmented with life-long learning experiences.

In addition, the Accreditation Board of Engineering and Technology Engineering, in conjunction with the American Society of Civil Engineers requires that baccalaureate degree graduates in civil engineering will be able to

- 1.) demonstrate proficiency in mathematics through differential equations, probability and statistics, calculus based physics and general chemistry;
- 2.) demonstrate proficiency in a minimum of four recognized major civil engineering areas;
- 3.) demonstrate the ability to conduct laboratory experiments and to critically analyze and interpret data in more than one of the recognized major civil engineering areas;
- 4.) demonstrate the ability to perform civil engineering design by means of design experience integrated throughout the professional component of the curriculum; and
- 5.) demonstrate an understanding of professional practice issues such as procurement of work; bidding versus quality-based selection processes; how the design professional and the construction professions interact to construct a project; the importance of professional licensure and continuing education; and/or other professional practice areas.

The Accreditation Board of Engineering and Technology Engineering Criteria 2000, in conjunction with the American Society of Civil Engineers requires that civil engineering curriculums include in-depth instruction allowing students to accomplish the integration of systems using appropriate analytical, computational and experimental practices. They also require that faculty teaching in civil engineering departments show evidence of understanding professional practice and maintain currency in their respective professional areas. Program faculty must have responsibility and sufficient authority to define, revise, implement, and achieve program objectives.

Freshman Year (33 credits)

C E 151, Introduction to Civil Engineering.....	3
C E 160, Geology for Engineers	4
ENGL 111G, Rhetoric and Composition.....	4
MATH 191, 192, Calculus and Analytic Geometry I, II.....	6
OEDG 109, Computer Drafting	3
PHYS 215, Engineering Physics I.....	3
PHYS 215L, Engineering Physics I Laboratory.....	1
SUR 222, Plane Surveying	3
Humanities or social science electives*.....	6

Sophomore Year (32 credits)

C E 231, Introduction to Fluid Mechanics.....	3
C E 233, Mechanics-Statics	3
C E 256, Environmental Science	3
C E 256L, Environmental Science Laboratory.....	1
C E 301, Mechanics of Materials.....	3
C E 331, Hydraulic Engineering	3
CHEM 111, General Chemistry I.....	4
ECON 251G, Principles of Macroeconomics, or ECON 252G, Principles of Microeconomics.....	3
ENGL 218G, Technical and Professional Communication	3
MATH 291, Calculus and Analytic Geometry III.....	3
M E 234, Mechanics-Dynamics.....	3

Junior Year (32 credits)

C E 311, Properties of Materials.....	3
C E 315, Determinate Structures.....	4
C E 356, Fundamentals of Environmental Engineering.....	3
C E 357, Soil Mechanics.....	3
C E 444, Steel Design, or C E 445, Concrete Design	3
COMM 265G, Principles of Human Communication	3
E E 201, Networks I, or M E 240, Thermodynamics	3
MATH 392, Differential Equations.....	3
STAT 371, Statistics for Engineers and Scientists I, or approved upper-division math elective.....	3
Science elective, PHYS 216 and PHYS 216L, Engineering Physics II and Lab, or CHEM 112, General Chemistry II	4

Senior Year (32 credits)

C E 450, Engineering Economy and Law.....	3
C E 497, Senior Seminar	2
Civil engineering options.....	18
Humanities or social science electives (upper-division)*	6
Humanities or social science elective*.....	3

*Humanities and social science electives must be selected to satisfy the college and university general education requirements.

Civil Engineering Options

Electives for Environmental Option (18 credits):

C E 382 Hydraulic systems Design; ENVE 455, Solid and Hazardous Waste Systems Design; and ENVE 456, Environmental Engineering Design....	9
A EN 459, Design of Water Wells/Pumping Systems; and C E 482, Hydraulic Structures.....	6
C E 444, Elements of Steel Design; G EN 452, Geohydrology; C E 471, Highway Engineering; C E 477, Construction Engineering (summer); A EN 478, Irrigation and Drainage Engineering; or C E 483, Surface Water Hydrology.....	3

Electives for Structural Option (18 credits):

C E 365, Intermediate Structural Mechanics; C E 444, Elements of Steel Design; or C E 445, Reinforced Concrete Design; C E 457, Foundation Design; and C E 469, Structural Systems	12
Select one of the two options below:	
Option 1: C E 443, Wood and Masonry Design and C E 468, Intermediate Mechanics of Materials	6
Option 2: C E 471, Highway Engineering; or C E 477, Construction Engineering (summer); and C E 443, Wood and Masonry Design or C E 468, Intermediate Mechanics of Materials.....	6

Electives for Water Resources Option (18 credits):

C E 482, Hydraulic Structures or G EN 485, Earthen Dam Design.....	3
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C E 382, Hydraulic Systems Design and C E 483, Surface Water Hydrology	6
A EN 459, Design of Water Wells/Pumping Systems or G EN 452, Geohydrology	3
A EN 475, Soil and Water Conservation; A EN 478, Irrigation and Drainage Engineering; A EN 479, Irrigation Systems Design and Management; or ENVE 456, Environmental Engineering Design	6

Electives for Geotechnical Option (18 credits):

G EN 452, Geohydrology; G EN 457, Foundation Design; G EN 459, Geomechanics and Rock Engineering; and G EN 485, Earthen Dam Design	12
G EN 453, G EN 498, C E 471, Highway Engineering or C E 482, Hydraulic Structures	6

Electives for General Civil Engineering Option (18 credits):

ENVE 456, Environmental Engineering Design; C E 469, Structural Systems, C E 482, Hydraulic Structures; or C E 485, Design of Earth Dams	3
C E 382, Hydraulic Systems Design; C E 444, Elements of Steel Design; C E 445, Reinforced Concrete Design; ENVE 455, Solid and Hazardous Waster Systems Design; or C E 457, Foundation Design	9
C E 471, Highway Engineering; C E 477, Construction Engineering; A EN 459, Design of Water Wells/Pumping Systems; G EN 452, Geohydrology; C E 483, Surface Water Hydrology; A EN 475, Soil and Water Conservation; A EN 478, Irrigation and Drainage Engineering; or A EN 479, Irrigation Systems Design and Management	6

MINOR: Agricultural Engineering

Minimum of 18 credits, designated as follows:

College of Agriculture and Home Economics

Soil Science Requirements, 3 credits from: SOIL 472, Soil morphology and Classification; SOIL 476, Soil Microbiology; SOIL 477, Soil Physics; SOIL 479, Environmental Soil Chemistry	3
Plant/Animal Science Requirement, 3 credits from: AGRO/HORT 365, Principles of Crop Production; ANSC 351G, Agricultural Animals of the World	3
Institutions/Economics Requirement, 3 credits from: AG E 315G, World Agriculture and Food Problems; AG E 337G, Natural Resources Economics; AG E 484, Water Resource Economics	3

College of Engineering

Irrigation Requirement, 3 credits from: AEN 478, Irrigation and Drainage Engineering; AEN 498, Special Topics	3
Engineering Specialty Requirement, 3 credits from: AEN 335, Engineering for Biological Systems; AEN 475, Soil and Water Conservation	3
Design Requirement, 3 credits from: AEN 440, Design Applications; AEN 459, Design of Water Wells/Pumping Systems	3

ENGINEERING PHYSICS

DEGREE: Bachelor of Science in Engineering Physics

The Engineering Physics program is offered jointly by the Physics Department and the College of Engineering. The faculty is drawn from the Departments of Physics, Electrical and Computer Engineering, and Mechanical Engineering.

A strong grasp of underlying physical principles behind the development of new technologies is necessary to keep up with new developments in a high-tech world. The BS in Engineering Physics program is designed to provide quality education of students for immediate employment with technical jobs in private industries (especially high-tech industries), research laboratories, and public sectors. The program trains students with a combination of engineering knowledge, physics principles, mathematical background, problem-solving strategies, and effective communicational skills. The BS in Engineering Physics also provides an excellent preparation for graduate studies in either physics or an engineering discipline.

The engineering physics program is offered jointly by the Department of Physics and College of Engineering. The BS in Engineering Physics confers an engineering credential. Students in the program complete an engineering core curriculum, either in Electrical and Computer Engineering or in Mechani-

cal Engineering, as well as a rigorous course of study in physics and mathematics. A strong laboratory component prepares students in experimental techniques and technology using state-of-the-art equipment.

The goals of the program are

- 1.) to give students a strong education in the fundamentals of physics, engineering, applied mathematics, and computation;
- 2.) to develop skill in real-world problem solving starting from fundamental physical principles;
- 3.) to improve communication skills; and
- 4.) to develop ability to work in a team.

The student must choose either the Electrical Engineering Option or the Mechanical Engineering Option. The requirements are listed below. Students must earn a C or better in all required courses.

Requirements for Electrical Option (128 or 129 credits)**Physics (40 or 41 credits)**

PHYS 213, Mechanics	3
PHYS 213L, Experimental Mechanics	1
PHYS 214, Electricity and Magnetism	3
PHYS 214L, Electricity and Magnetism Laboratory	1
PHYS 217, Heat, Light, and Sound	3
PHYS 217L, Experimental Heat, Light, and Sound	1
PHYS 315, Modern Physics	3
PHYS 315L, Experimental Modern Physics	2
PHYS 451, Intermediate Mechanics I	3
PHYS 454, Intermediate Modern Physics I	3
PHYS 455, Intermediate Modern Physics II	3
PHYS 475, Advanced Experimental Modern Physics 3, or PHYS 471, Modern Experimental Optics	2
PHYS 480, Thermodynamics	3
PHYS 495, Mathematical Methods of Physics I	3
Physics electives	6

Electrical Engineering (41 credits)

E E 111, Introduction to Electrical and Computer Engineering	4
E E 161, Computer-Aided Problem Solving	4
E E 211, AC Circuits	4
E E 221, Electronics I	4
E E 261, Digital Design I	4
E E 311, Signals and Systems	4
E E 315, Electromagnetics I	4
E E 341, Control Systems, or E E 332, Introduction to Electrical Power Engineering	4
E E 498, Capstone Design I	3
E E 499, Capstone Design II	3
Electrical engineering elective	3

Mathematics (15 credits)

MATH 191, Calculus and Analytic Geometry I	3
MATH 192, Calculus and Analytic Geometry II	3
MATH 291, Calculus and Analytic Geometry III	3
E E 301, Vector Principles	3
MATH 392, Ordinary Differential Equations	3

Natural Science (4 credits)

CHEM 111, General Chemistry I	4
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Additional General Education Requirements (28 credits)

ENGL 111G, Rhetoric and Composition	4
ENGL 218G, Technical and Scientific Communication	3
Critical thinking/analysis elective (noncomputer)	3
Historical perspective elective	3
Human thought elective	3
Social analysis elective	3
Literature/fine arts elective	3
Viewing a Wider World electives*	6

*Viewing a Wider World courses cannot be taken in engineering or physics.

Requirements for Mechanical Option (128 credits)**Physics (38 credits)**

PHYS 213, Mechanics	3
PHYS 213L, Experimental Mechanics	1

PHYS 214, Electricity and Magnetism	3
PHYS 214L, Electricity and Magnetism Laboratory	1
PHYS 217, Heat, Light, and Sound	3
PHYS 217L, Experimental Heat, Light, and Sound	1
PHYS 315, Modern Physics	3
PHYS 315L, Experimental Modern Physics	2
PHYS 454, Intermediate Modern Physics I	3
PHYS 455, Intermediate Modern Physics II	3
PHYS 461, Intermediate Electricity and Magnetism I	3
PHYS 462, Intermediate Electricity and Magnetism II	3
PHYS 475, Advanced Experimental Modern Physics	3
PHYS 495, Mathematical Methods of Physics I	3
Physics elective	3

Mechanical Engineering (43 credits)

C E 301, Mechanics of Materials	3
M E 102, Introduction to Mechanical Engineering	1
M E 159, Graphical Communication and Design	2
M E 236, Engineering Mechanics I	3
M E 237, Engineering Mechanics II	3
M E 240, Thermodynamics	3
M E 260, Mechanical Engineering Problem Solving	3
M E 328, Engineering Analysis I	3
M E 329, Engineering Analysis II	3
M E 333, Intermediate Dynamics	3
M E 338, Fluid Mechanics	3
M E 341, Heat Transfer	3
M E 426, Design Project Laboratory I	3
M E 427, Design Project Laboratory II	3
M E 449, Senior Seminar	1
Engineering elective	3

Mathematics (15 credits)

MATH 191, Calculus and Analytic Geometry I	3
MATH 192, Calculus and Analytic Geometry II	3
MATH 291, Calculus and Analytic Geometry III	3
MATH 392, Ordinary Differential Equations	3
Math elective from M E list	3

Natural Science (4 credits)

CHEM 111, General Chemistry I	4
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Additional General Education requirements (28 credits)

ENGL 111G, Rhetoric and Composition	4
ENGL 218G, Technical and Scientific Communication	3
Critical thinking/analysis elective (non-computer)	3
Historical perspective elective	3
Human thought elective	3
Social analysis elective	3
Literature/fine arts elective	3
Viewing a Wider World electives*	6

*Viewing a Wider World courses may not be taken in engineering or physics.

ELECTRICAL and COMPUTER ENGINEERING

The Klipsch School of Electrical and Computer Engineering

College Associate Professor Professor Krist Petersen, interim department head

Associate Professor Paul Furth, associate department head

College Associate Professor Sheila Horan, freshman adviser

Professors Black, (emeritus), Carden (emeritus), Castillo, Flachs (emeritus), Giles, Stephen Horan, Johnson*, Jordan (emeritus), Kazda (emeritus), Kersting (emeritus), Ludeman (emeritus), Merrill (emeritus), Ng, Ramirez-Angulo, Ranade, Reinfelds (emeritus), Smolleck*, Steelman* (emeritus), Stochaj, Taylor (emeritus); **Associate Professors**, DeLeon, Furth, Jedlicka, Paz, Prasad, Voelz; **Assistant Professors** Borah, Cook, Creusere, Huang, Lyman, Mitra;

College Associate Professors Sheila Horan, Petersen; **College Assistant Professor** Phippen; **Adjunct Professor** Vorontsov; **Adjunct Assistant Professors** Ellis, Garcia; **Adjunct Instructors** Boehmer, Geyer
(505) 646-3115; eeoffice@nmsu.edu; www.ece.nmsu.edu
*Registered Professional Engineer (NM)

DEGREE: Bachelor of Science in Electrical Engineering

The undergraduate program of the Klipsch School is fully accredited by the Accreditation Board for Engineering and Technology (ABET) and stresses the development of analytical tools and physical concepts required to prepare students for immediate employment or graduate study. The program is flexible, allowing students to choose course work in the interest areas of communications, computers, control systems, digital design, electric energy systems, electromagnetics and microwave engineering, micro-electronics, photonics, signal processing, telemetry, and space systems engineering.

Electrical Engineering Program Education Objectives

The Klipsch School is dedicated to providing a quality, hands-on, educational experience. Upon graduation, students will have the technical, communication, and critical thinking skills necessary to begin a fulfilling career and/or pursue graduate studies in electrical and computer engineering. Baccalaureate graduates of the Klipsch School are:

- able to apply engineering, science, and mathematical skills to meet the technical challenges in electrical engineering
- experienced in the design process: conceptualization, solution, formulation, implementation, and verification
- able to communicate effectively and operate in diverse teams
- aware of their professional and ethical responsibilities as practicing engineers
- prepared for productive employment and/or the pursuit of an advanced degree

Requirements (total credits 128)**Electrical Engineering (54 credits)**

E E 111, Introduction to Electrical and Computer Engineering ^{1,2}	4
E E 161, Computer-Aided Problem Solving ^{1, 2, 3}	4
E E 211, AC Circuits ^{1, 2}	4
E E 221, Electronics ^{1, 2}	4
E E 261, Digital Design ^{1, 2}	4
E E 311, Signals and Systems ^{1, 2}	4
E E 315, Electromagnetics ^{1, 2}	4
E E 332, Introduction to Electric Power Engineering ^{1, 2}	4
E E 341, Systems I ^{1, 2}	4
EE Electives*	12
Capstone Elective*	6

Mathematics (21 credits)

MATH 191, Calculus I ²	3
MATH 192, Calculus II ²	3
MATH 291, Calculus III ²	3
E E 301, Vector Principles ²	3
MATH 392, Differential Equations	3
Statistics Elective*	3
Math Elective*	3

Natural Science (12 credits)

CHEM 111, General Chemistry I ¹	4
PHYS 215, General Physics I ^{1,2}	4
PHYS 216 or 217, General Physics II ^{1,2}	4

Engineering (13 credits)

E E 461, Program Management	3
Engineering elective*	3
Technical elective*	6

General Education (28 credits)

ENGL 111G, Rhetoric and Composition ²	4
ENGL 218G, Technical and Scientific Communication	3
COMM 265G, Principles of Human Communication	3
Historical Perspective Elective*	3
Human Thought Elective*	3
Literature/Fine Arts Elective*	3
ECON 251G, Macroeconomics, or ECON 252G, Microeconomics	3

Viewing a Wider World Electives*6
 Free elective1

- 1 Including laboratory
- 2 A grade of C or better is required
- 3 Must be completed with a grade of C or better prior to enrolling in any E E course numbered 300, or above
- * Lists of approved electives are available from the Klipsch School office

THE FRESHMAN YEAR

Students must be eligible to take MATH 191 before beginning their electrical engineering studies. A typical first year of study for E E students includes the following 29 credits:

CHEM 111, General Chemistry I4
 E E 111, Introduction to Electrical and Computer Engineering.....4
 E E 161, Computer-Aided Problem Solving4
 E E 261, Digital Design I4
 ENGL 111G, Rhetoric and Composition.....4
 MATH 191, Calculus I*3
 MATH 192, Calculus II.....3
 General Education Elective3
 *Eligibility for MATH 191 must be established by taking the Math Placement Exam, administered by the Math Learning Center

INTEREST AREAS

Through the proper choice of math, science, and engineering electives in the junior and senior years, it is possible for the student to specialize in an area of interest. These areas include:

- 1.) *Communications, Telemetry, and Signal Processing*
 Students study space communication systems, wireless systems, telemetry, or signal processing. Scholarships and employment opportunities are available in the Manuel Lujan Center for Telemetry and Telecommunications.
- 2.) *Electric Energy Systems*
 Elective courses in power systems acquaint the student with the design, analysis, and operation of power systems. Courses are offered in high voltage transmission lines, distribution systems, rotating machines, and digital computer analysis of the steady state operation and short circuit conditions of a power system.
- 3.) *Electromagnetics and Microwave Engineering*
 Students study electromagnetic fields, wave propagation, antennas, waveguides, transmission lines, lasers, and optics. Practical experience is available in the high-frequency and antenna laboratories and anechoic chamber.
- 4.) *Micro-Electronics*
 Students study discrete analog as well as digital and analog VLSI electronics, preparing them for design, analysis, and testing of complex circuits. During the senior year, VLSI students will design a chip to be fabricated.
- 5.) *Photonics*
 Students may concentrate in the fields of fiber optics, lasers, optical communications, imaging, and optical signal processing.
- 6.) *Control Systems*
 Work in the systems area provides the student with a background in modeling, analysis, design, simulation, and control of complex systems. These systems may be associated with engineering, ecology, transportation, natural resources, environment, or other areas.
- 7.) *Space Systems Engineering*
 Elective courses prepare the student for employment opportunities in the aerospace industry. Students are introduced to the complexities of a space systems life cycle and the disciplines required to design, integrate, and operate large systems.

COMPUTER ENGINEERING SPECIALIZATION

The school offers a special program for students interested in computer engineering. Students wishing to become involved in this rapidly growing field will find courses in the Klipsch School, as well as the Computer Science Department which cover the following areas:

- Integrated Circuits and Applications
- Digital Logic and System Design
- High Performance Computer Design

- Digital Signal Processing
- Digital Control and Instrumentation Systems
- Computer Architecture
- Data Networks
- Software Engineering
- Operating Systems

These courses offer the student an opportunity to obtain an in-depth knowledge of digital systems and practical experience in the design, operation, programming, and applications of digital computers.

RELATED AREAS OF STUDY

Electrical and computer engineering students wishing to broaden their educational experience may elect to earn additional bachelors degrees in

- Engineering Physics
- Physics
- Mathematics
- Computer Science

Klipsch School students may also choose to earn a minor in one or more of the following fields:

- Physics
- Mathematics
- Computer Science

Students must consult with an academic adviser in the offering department for specific requirements related to additional degrees and minors.

DESIGNATED MINORS

Students from outside the Klipsch School may earn a minor in Electrical or Computer Engineering.

MINOR: Electrical Engineering (total credits 22)

Prerequisites¹ (12 credits) all may be transferred

MATH 191, Calculus I⁴3
 MATH 192, Calculus II⁴3
 MATH 291, Calculus III⁴3
 MATH 392, Differential Equations⁴3

Lower Division (12 credits) maximum of 8 transfer credits

E E 111, Introduction to Electrical and Computer Engineering^{2, 3, 4}4
 E E 211, AC Circuits^{2, 4}4
 E E 221, Electronics I^{2, 4}4

Upper Division (10 credits) no transfer credit accepted

E E 311, Signals and Systems^{2, 4}4
 Electives *6

¹ Certain electives may require additional prerequisites.

² Including laboratory

³ E E 201 may be substituted

⁴ A grade of C or better is required

*Lists of approved electives are available from the Klipsch School office

MINOR: Computer Engineering (total credits 21)

Prerequisites¹ (9 credits) all may be transferred

E E 111, E E 201, or an equivalent DC Circuits course⁴3
 MATH 191, Calculus I⁴3
 MATH 192, Calculus II⁴3

Lower Division (8 credits) all may be transferred

E E 161, Computer Aided Problem Solving^{2, 3, 4}4
 E E 261, Digital Design I^{2, 4}4

Upper Division (13 credits) no transfer credit accepted

E E 361, Digital Design II3
 E E 363, Computer Architecture I²4
 Electives*6

¹ Certain electives may require additional prerequisites

² Including laboratory

³ A challenge exam is required before transfer credit is accepted

⁴ A grade of C or better is required

*Lists of approved electives are available from the Klipsch School office

ENGINEERING TECHNOLOGY

Associate Professor Sonya L. Cooper*, interim department head

Professors Alexander*, Beasley, P. Ricketts*, **Associate Professors** Cooper*, Cox, Hyde, Jenkins, Kelly, C. Ricketts, Rico; **Assistant Professors** Morrell, Stevens*

(505) 646-2236; nmsuet@nmsu.edu

*Registered Professional Engineer (NM)

DEGREE: Bachelor of Science in Engineering Technology

PROGRAM: Civil Engineering Technology

EMPHASIS: Construction Technology

PROGRAM: Electronics & Computer Engineering Technology

PROGRAM: Mechanical Engineering Technology

DEGREE: Bachelor of Information and Communication Technology

MINORS: Manufacturing

Security Technology and Intelligence Studies

Engineering Technology

Engineering technology education places an emphasis on the practical application of engineering principles and methods. Engineering technology graduates have employment opportunities in areas such as product and systems development, manufacturing, technical and project management, construction, facilities planning and operation, and testing.

Lists of course equivalencies are available for students transferring to NMSU from most New Mexico and some out-of-state institutions. In addition, the department has some extended articulation agreements or can provide a method of validation of transfer coursework in many technical subject areas. The department requires that at least 21 credits specifically in the transfer student's program must be earned at the main campus of NMSU. General degree requirements of the College of Engineering and university apply to students in the Department of Engineering Technology. Many ET-prefixed courses carry one or more prerequisites. The instructor of a course may waive a prerequisite(s) for a student, if doing so will not negatively impact the quality of the student's educational experience.

The department also offers associate degree programs in Electronics and Computer, Mechanical, and Civil Engineering Technology.

The mission of the Department of Engineering Technology is to provide students with a quality engineering technology education that links theory and application and that gives students enhanced career opportunities. The department's goals supporting this mission are: (1) to provide educational and social environments that promote and facilitate student learning; (2) to have a highly respected and visible department; (3) to foster the development of the department; and (4) to graduate students who are competent and sought after by industry.

Engineering technology graduates will demonstrate the following skills:

- an appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines;
- an ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering and technology;
- an ability to conduct, analyze and interpret experiments and apply experimental results to improve processes;
- an ability to apply creativity in the design of systems, components or processes appropriate to program objectives;
- an ability to function effectively on teams;
- an ability to identify, analyze and solve technical problems;
- an ability to communicate effectively;
- an ability to recognize the need for and possess the ability to pursue lifelong learning;
- an ability to understand professional, ethical and social responsibilities;
- an ability to recognize contemporary professional, societal and global issues and be aware of and respect diversity; and

- an ability to have a commitment to quality, timeliness and continuous improvement.

INFORMATION AND COMMUNICATION TECHNOLOGY

Information and Communication Technology is a distance education, degree completion program. The program focuses on the knowledge and experience that is required to design, implement, and manage a variety of information systems. The curriculum includes the study of computer hardware, application and operating systems software, system integration, database design and management, networking, and network security. Graduates of the program can expect to enter the workforce with titles that include Information Technologist, Systems or Network Administrator, Project Manager, Database Administrator, and Computer Support Specialist.

The program is designed to be an educational path to the baccalaureate degree for graduates of computer and technology-related associate degree programs from community colleges or other two-year institutions. It is also a viable degree path for students who have completed the freshmen and sophomore years of computer or technology-related programs at four-year institutions including, of course, New Mexico State University.

The program is predominantly conducted in distance format, although a limited number of brief, on-campus laboratory or testing sessions may be required in certain classes. Students who are successful in distance education programs typically are self-motivated, do not rely heavily on face-to-face instruction, work independently, and can remain on schedule.

This program was not designed to be an engineering or engineering technology program although there is significant overlap with one of the engineering technology programs offered by the department. **Thus, the Information and Communication Technology Program differs from the other baccalaureate programs offered by the departments in the College of Engineering in that it is not accredited by the Accreditation Board for Engineering and Technology (ABET).**

Upon completion of the degree requirements, graduates will demonstrate the following:

- an appropriate mastery of the knowledge, techniques, skills and modern tools of information and communications technology;
- an ability to apply current knowledge and adapt to emerging applications of technology;
- an ability to communicate effectively;
- an ability to understand professional, ethical and social responsibilities;
- an ability to apply creativity in the design of systems;
- an ability to identify, analyze and solve technical problems;
- an ability to recognize the need for and possess the ability to pursue lifelong learning;
- an ability to recognize contemporary professional, societal, and global issues and be aware of and respect diversity; and
- an ability to have a commitment to quality, timeliness and continuous improvement.

DEGREE: Bachelor of Science in Engineering Technology

PROGRAM: Civil Engineering Technology (Total credits 133)

Accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology.

Freshman Year (34 credits)

CHEM 110G, Principles and Applications of Chemistry	4
ENGL 111G, Rhetoric and Composition	4
ET 101, Introduction to Engineering Technology	1
ET 109, Computer Drafting Fundamentals	3
ET 120, Computation and Presentation Software	3
ET 154, Construction Methods and Communications	3
ET 254, Concrete Technology	3
MATH 180, Trigonometry	3
MATH 185, College Algebra	3
PHYS 211-211L, General Physics I, General Physics Lab I	4
Approved Literature or Fine Arts elective*	3

Sophomore Year (36 credits)

COMM 265G, Principles of Human Communication	3
ECON 251G, Principles of Macroeconomics, or ECON 252, Principles of Microeconomics	3
ENGL 218G, Technical and Scientific Communication	3

ET 143, Civil/Survey Drafting I.....	3
E T 240, Applied Statics.....	3
E T 241, Applied Dynamics.....	2
Approved Human Thought and Behavior elective*.....	3
Approved Historical Perspective elective*.....	3
MATH 235, 236, Calculus for the Technical Student I, II.....	6
PHYS 212-212L, General Physics II, General Physics Lab II.....	4
SUR 222, Plane Surveying.....	3

Junior Year (34 credits)

E ST 311G, Statistical Applications.....	3
E T 306, Fundamental and Applied Thermodynamics.....	3
E T 308, Fluid Technology.....	3
E T 308L, Fluid Technology Lab.....	1
E T 310, Applied Strength of Materials.....	3
E T 310L, Applied Strength of Materials Lab.....	1
E T 332, Applied Design of Structures I.....	4
E T 354, Soil and Foundation Technology.....	4
E T 355, Site/Land Development and Layout.....	3
E T 361, Safety Systems and Programs.....	3
MGT 315G, Human Relations in Organizations, or MGT 388G, Leadership and Society**.....	3
Technical elective**.....	3

Senior Year (29 credits)

C E 450, Engineering Economy and Law, or I E/CH E 451, Engineering Economy**.....	3
E T 410, Senior Seminar.....	1
E T 412, Highway Technology.....	3
E T 418, Applied Hydraulics.....	3
E T 420, Senior Internship, or E T 435, Senior Design and Project Management.....	3
E T 432, Applied Design of Structures II.....	4
Approved surveying elective**.....	3
Approved technical electives**.....	6
Approved Viewing a Wider World elective*.....	3

****Construction Emphasis Requirements**

For the construction emphasis, the six courses denoted with ** in the general civil program above are replaced with the following courses:

BLAW 317, Business Law.....	3
E T 454, Advanced Construction Technology.....	3
E T 455, Cost Estimating and Scheduling.....	3
Management courses numbered 400 or above, or E T 490, Selected Topics (subtitle: Project Management).....	3
MGT 360G, Negotiations.....	3
SUR 328, Construction Surveying.....	3

DEGREE: Bachelor of Science in Engineering Technology**PROGRAM: Electronics and Computer Engineering Technology (Total Credits 129)**

Accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology

Freshman Year (32 credits)

COMM 265G, Principles of Human Communication.....	3
ENGL 111G, Rhetoric and Composition.....	4
E T 101, Introduction to Engineering Technology.....	1
E T 120, Computational and Presentation Software.....	3
E T 182, Digital Logic.....	3
E T 190, Applied Circuits.....	4
E T 191, Applied Circuits Laboratory.....	1
MATH 180, Trigonometry.....	3
MATH 185, College Algebra.....	3
PHYS 211-211L, General Physics I, General Physics Lab I.....	4
Approved Human Thought and Behavior elective*.....	3

Sophomore Year (35 credits)

CHEM 110G, Principles and Applications of Chemistry.....	4
ENGL 218G, Technical and Scientific Communication.....	3
E T 246, Electronic Devices I.....	4
E T 262, Software Technology I.....	3

E T 272, Electronic Devices II.....	4
E T 282, Digital Electronics.....	4
MATH 235, 236, Calculus for the Technical Student I, II.....	6
PHYS 212-212L, General Physics II, General Physics Lab II.....	4
ECON 251G, Principles of Macroeconomics or ECON 252G, Principles of Microeconomics.....	3

Junior Year (31 credits)

E ST 311G, Statistical Applications, or E T 302, Manufacturing Data Analysis.....	3
E T 324, Linear Integrated Circuits.....	4
E T 344, Microcomputer Systems.....	3
E T 362, Software Technology II.....	3
E T 377, Computer Networking.....	3
E T 398, Digital Systems.....	3
MGT 315G, Human Relations in Organizations or MGT 388G, Leadership and Society.....	3
Approved technical elective.....	3
Approved Literature of Fine Arts elective*.....	3
Approved Historical Perspective elective*.....	3

Senior Year (31 credits)

C E 450, Engineering Economy and Law, or I E/CH E 451, Engineering Economy.....	3
E T 361, Safety Systems and Programs.....	3
E T 402, Instrumentation.....	3
E T 404, Quality in Manufacturing.....	3
E T 410, Senior Seminar.....	1
E T 444, Hardware Senior Design.....	3
E T 462, Operating Systems and Interfacing.....	3
Approved management, business, or marketing elective.....	3
Approved technical electives.....	6
Approved Viewing a Wider World elective*.....	3

DEGREE: Bachelor of Science in Engineering Technology**PROGRAM: Mechanical Engineering Technology (Total credits 133)**

Accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology.

Freshman Year (34 credits)

ENGL 111G, Rhetoric and Composition.....	4
E T 101, Introduction to Engineering Technology.....	1
E T 110, Introduction to Mechanical Engineering Technology.....	3
E T 117, Introduction to Materials.....	2
E T 120, Computation and Presentation Software.....	3
E T 182, Digital Logic.....	3
E T 190, Applied Circuits.....	4
E T 191, Applied Circuits Laboratory.....	1
MATH 180, Trigonometry.....	3
MATH 185, College Algebra.....	3
PHYS 211-211L, General Physics I, General Physics Lab I.....	4
Approved Literature of Fine Arts elective*.....	3

Sophomore Year (35 credits)

CHEM 110G, Principles and Applications of Chemistry.....	4
COMM 265G, Principles of Human Communication.....	3
ENGL 218G, Technical and Scientific Communication.....	3
E T 217, Manufacturing Processes.....	2
E T 217L, Manufacturing Processes Lab.....	1
E T 240, Applied Statics.....	3
E T 241, Applied Dynamics.....	2
E T 262, Software Technology I.....	3
E T 306, Fundamental and Applied Thermodynamics.....	3
E T 306L, Thermodynamics Lab.....	1
MATH 235, 236, Calculus for the Technical Student I, II.....	6
PHYS 212-212L, General Physics II, General Physics Lab II.....	4

Junior Year (30 credits)

Approved Human Thought and Behavior elective*.....	3
ECON 251G, Principles of Macroeconomics, or ECON 252G, Principles of Microeconomics.....	3
E ST 311G, Statistical Applications, or E T 302, Manufacturing Data	

Analysis3
 E T 310, Applied Strength of Materials.....3
 E T 310L, Applied Strength of Materials Lab1
 E T 308, Fluid Technology3
 E T 308L, Fluid Technology Lab.....1
 E T 328, Kinematics of Machines.....4
 E T 396, Heat Transfer and Applications.....3
 MGT 315G, Human Relations in Organizations or MGT 388G, Leadership and Society3
 Approved technical elective.....3

Senior Year (34 credits)

C E 450, Engineering Economy and Law, or I E /CH E 451, Engineering Economy.....3
 E T 361, Safety Systems and Programs3
 E T 402, Instrumentation.....3
 E T 404, Quality in Manufacturing.....3
 E T 410, Senior Seminar1
 E T 426, Analysis/Design of Machine Elements3
 E T 435, Senior Design and Project Management.....3
 Approved management, business, marketing elective, or upper division math course.....3
 Approved technical electives.....6
 Approved Historical Perspective elective*3
 Approved Viewing a Wider World elective*.....3

Note: Lists of approved technical and General Education electives are available from the Department of Engineering Technology.

*Courses taken to satisfy these General Education requirements my be taken in any order.

DEGREE: Bachelor of Information and Communication Technology

The following are prerequisites for entry into the Information and Communication Technology Program:

(a) An associate's degree or at least 62 credits from an accredited educational institution to include courses as follows:

- freshman English
- technical or research writing
- oral communications
- college algebra
- a second mathematics course from an approved list
- basic computer literacy, including office productivity tools
- at least one course in computer programming
- a 4-credit, natural science course with an accompanying laboratory (e.g., chemistry, physics, biology)

The applicant must have familiarity with and access to a computer with a CD drive, a current web browser, a 56K or higher data rate connection to the Internet, and email capability. Software that may be required for specific courses will often be available at student discount prices from the university bookstore, as well as from other sources.

(b) Completion of the following courses (37 credits):

ICT 320, Applications Software for Engineering Technologists 3
 ICT 339, Computer Forensics 3
 ICT 345, Computer Hardware Fundamentals 3
 ICT 362, Software Technology II 3
 ICT 377, Computer Networking I 3
 ICT 410, Senior Seminar 1
 ICT 420, Senior Internship or ICT 435, Senior Design and Project Management, or an approved elective 3
 ICT 456, Analysis of Physical Security Systems 3
 ICT 457, Introduction to Information Security 3
 ICT 458, Database Design And Applications 3
 ICT 462, Operating Systems and Interfacing 3
 ICT 463, Computer Systems Administration 3
 ICT 477, Computer Networking II 3

(c) Completion of the university's general education requirements (see the "General Education Courses and Requirements" section of this Catalog).

(d) An advisor will assist students in selecting any additional courses that may be required to meet the baccalaureate degree requirements of 128 credits with at least 54 credits in upper division (junior or senior level) courses. Information and Communication Technology majors must comply with all New Mexico State University, College of Engineering, and Department of Engineering Technology

requirements for the baccalaureate degree as specified in the relevant sections of this Catalog.

MINOR: Manufacturing

A student must pass 18 credits with a grade of C or higher as outlined below. No courses may be taken S/U.

ET 110 Introduction to Computer-Aided Drafting and Design or ME 159, Graphica Communication and Design or similar approved course; ET 217/217L or IE 217/217L, Manufacturing Processes/Laboratory; ET 415, Manufacturing Management & Productivity or IE 316, Methods Engineering or ET 309G, Manufacturing: History and Technology; ET 305, Design for Manufacturing or IE 424, Production and Inventory Control12
 One of the following: ET 404, Quality in Manufacturing; IE 310G, Continuous Quality Improvement; IE 365, Quality Control; or MGT 345, Operations Planning and Control3

ET 482 or IE 482, Concepts in Computer Integrated Manufacturing I3

Note: Students in the College of Engineering cannot use ET 309G as a technical elective or to meet Viewing Wider World General Education requirements.

MINOR: Security Technology and Intelligence Studies

A student must pass 18 credits with a grade of C or higher as outlined below. No courses may be taken S/U. A student must register in the minor before enrolling in any upper division Criminal Justice courses.

1. All students must complete the following: ET/ICT 456, Analysis of Physical Security Systems.....3
2. Any two C J courses from the following: CJ 321, Criminal Investigation and Intelligence; CJ 412, Introduction to Security Technology and Loss Prevention; CJ 425, Ethics in Criminal Justice.....6
3. One of the following ET courses: ET/ICT 457, Introduction to Information Security; ET/ICT 458, Database Design and Application3
4. Any two courses from the following, or any courses listed in #2 and #3 not completed: CJ 322, Organized Crime; CJ 411, Nature of Crime; CJ 432, Issues in Criminal Justice to be Approved by CJ Department Head; CJ 480, Criminal Justice Planning & Crime Analysis; CJ 483, errorists CJ 484, Hate Crimes & Domestic Terrorism; ET/ICT 339, Computer Forensics; ET/ICT 377, Computer Networking (for use by students not majoring in ETE); ET/ICT 490, Selected Topics to be Approved by ET Department Head6

Three upper division CJ courses may meet 3 of the 6-credit Viewing a Wider World requirements for students majoring outside of the Col. of Arts & Sciences. Three upper division ET courses may meet 3 of the 6-credit Viewing a Wider World requirements for students majoring outside of the College of Engineering.

INDUSTRIAL ENGINEERING

Associate Professor Edward Pines, department head

Associate Professors Mullen, Pines; **Assistant Professors** Cecil, Matis, Valles-Rosales; **College Associate Professor** Green
 (505) 646-4923

DEGREE: Bachelor of Science in Industrial Engineering

Industrial engineers design, develop, install and improve integrated systems of people, equipment, information, financial resources, software, materials, and energy. Industrial engineers work in a variety of manufacturing, health care, utility, retail, government and research settings, therefore the tools and methods of the industrial engineer are both varied and broad. They use knowledge and skills in engineering, mathematics, and physical and social sciences along with the principles and methods of engineering analysis and design to monitor and improve such systems. New Mexico State University's undergraduate degree program in Industrial Engineering prepares students to join the work force or pursue graduate education while setting the foundation for life-long learning.

Specifically, graduates of the program will be:

- able to apply various industrial engineering techniques in an integrated fashion to solve real world problems in process design and/or improvement;

- able to obtain meaningful employment or enroll in a graduate program; and
- prepared for a long-term, successful career sustained by life-long learning experiences.

In addition, the Accreditation Board of Engineering and Technology Engineering Criteria 2000, in conjunction with the Institute of Industrial Engineers, requires that:

- baccalaureate degree graduates will be able to demonstrate the ability to design, develop, implement and improve integrated systems that include people, materials, information, equipment and energy;
- industrial engineering curriculums include in-depth instruction allowing students to accomplish the integration of systems using appropriate analytical, computational and experimental practices; and
- that faculty teaching in industrial engineering departments show evidence of understanding professional practice and maintain currency in their respective professional areas. Program faculty must have responsibility and sufficient authority to define, revise, implement, and achieve program objectives.

Requirements (Total credits 133)

In addition to the university requirements for graduation, a student must have a 2.0 grade-point average in all departmental courses and take the Fundamentals of Engineering Examination prior to graduation.

Freshman Year (33 credits)

CHEM 111, General Chemistry I.....	4
ENGL 111G, Rhetoric and Composition.....	4
I E 110, Industrial Engineering Orientation.....	1
I E 151, Computational Methods in Industrial Engineering I.....	3
I E 152, Introduction to Industrial Engineering.....	2
MATH 191, 192, Calculus and Analytic Geometry I, II.....	6
M E 159, Graphical Communication and Design.....	2
PHYS 215, Engineering Physics I.....	3
PHYS 215L, Engineering Physics I Lab.....	1
Approved general education elective: Literature and Fine Arts**.....	3
Science elective*.....	4

Sophomore Year (33 credits)

C E 233, Mechanics-Statics, or M E 236, Engineering Mechanics I.....	3
ECON 251G, Principles of Macroeconomics.....	3
I E 217, Manufacturing Processes.....	2
I E 217L, Manufacturing Processes Lab.....	1
I E 311, Engineering Data Analysis.....	3
I E 351, Computation Methods in Industrial Engineering II.....	3
MATH 291 Calculus and Analytic Geometry III.....	3
PSY 201G, Introduction to Psychology.....	3
Engineering science elective*.....	6
Math elective* (Linear Algebra).....	3
Science elective*.....	3

Junior Year (33 credits)

ACCT 251, Management Accounting.....	3
CH E 361, Engineering Materials.....	3
ENGL 218G, Technical and Professional Communication.....	3
I E 316, Methods Engineering.....	3
I E 365, Quality Control.....	3
I E 467, Simulation Modeling.....	4
MATH 392, Differential Equations.....	3
Math elective*, upper-division.....	3
Engineering elective*.....	3
Approved general education elective: Historical Perspectives**.....	3
Approved general education elective: Viewing a Wider World†.....	3

Senior Year (33 credits)

COMM 265G, Principles of Human Communication.....	3
I E 413, Engineering Operations Research I.....	3
I E 423, Engineering Operations Research II.....	3
I E 424, Manufacturing Systems.....	3
I E 451, Engineering Economy.....	3
I E 460, Evaluation of Engineering Data.....	3
I E 478, Facilities Planning and Design.....	3
I E 480, Senior Design.....	3
Engineering electives*.....	6

Approved general education elective: Viewing a Wider World†.....3

*A detailed list of approved electives is available in the Department of Industrial Engineering.

**The catalog section "General Education Courses and Requirements" includes a list of approved electives.

***A two-course sequence in either physics or chemistry is required.

†A detailed list of approved VWW electives is available in the Department of Industrial Engineering. Students should choose VWW electives that meet the ABET humanities and social science requirements.

MECHANICAL ENGINEERING

Associate Professor Ronald J. Pederson†, interim department head

Professors Genin†, Hardee*†, Hills, Smith* (emeritus); **Associate Professors** Choo, Conley†, Garcia, Leslie, Ma; **Assistant Professors** Allen, Park, Sevostianov, Shashikanth; **College Professors** Donaldson*, Hill
(505) 646-3501

*Registered Professional Engineer (NM)

†Registered Professional Engineer (State other than NM)

DEGREE: Bachelor of Science in Mechanical Engineering

The mechanical engineering program prepares students for a wide range of professional engineering careers in such areas as research and development, design, facilities operation and maintenance, management, and production. Graduates of the program will be prepared to apply engineering sciences, mathematics, computational methods, modern experimental methods, and effective communication skills to problems of interest in industry and government or scholarly topics. Employment opportunities for graduates are extensive. These include energy and utility, manufacturing, automotive, aerospace, defense and space, research and development, and many others. The emphasis in the curriculum is on engineering sciences (solid mechanics, thermal sciences, fluid mechanics, and materials science), mathematics, engineering analysis, engineering design, general sciences, and communication balanced with general education topics and electives. Graduates of the program will also be prepared for graduate studies (subject to grade-point and standardized test qualifications). Students will be prepared to take the fundamentals of engineering examination (and are encouraged to do so) as a step towards professional registration.

Mechanical Engineering Educational Goals and Objectives

The goals of the Department of Mechanical Engineering, as set forth in the departmental strategic plan, are

- to educate those who will advance knowledge and become the future leaders of industry and academia;
- to conduct both basic and applied research in mechanical engineering and related interdisciplinary areas; and
- to provide service to the profession, to the State of New Mexico, to the country, and to the future development of engineering world wide.

A critical focus within the department is to afford undergraduates of varying backgrounds and abilities every opportunity for achieving success in the mechanical engineering profession. To address this focus, the faculty of the mechanical engineering department, with input from other constituents, have established the following educational objectives for the undergraduate program:

- to prepare students for successful careers and lifelong learning;
- to educate students thoroughly in engineering science and methods of analysis, including the mathematical and computational methods appropriate for engineers to use when solving problems;
- to develop the skills pertinent to the design process, including the students' ability to formulate problems, to think creatively, to communicate effectively, to synthesize information, and to work collaboratively;
- to teach students to use modern experimental and data analysis techniques; and
- to instill in our students an understanding of their professional and ethical responsibilities.

Graduation Requirements

In addition to the NMSU requirements for graduation, a student must obtain a minimum grade of C in mechanical engineering courses.

Requirements (Total credits 129)**Freshman Year (32 credits)**

CHEM 111, General Chemistry I, and CHEM 112, Chemistry II.....	8
ENGL 111G, Rhetoric and Composition.....	4
ENGL 218G, Technical and Scientific Communication.....	3
MATH 191, 192, Calculus and Analytic Geometry I, II.....	6
M E 102, Mechanical Engineering Orientation.....	1
M E 159, Graphical Communication and Design.....	2
M E 166, Introduction to Mechanical Engineering.....	2
M E 222, Product Development Laboratory.....	3
Approved General Education Literature and Fine Arts elective.....	3

Sophomore Year (33 credits)

C E 301, Mechanics of Materials.....	3
COMM 265G, Principles of Human Communication.....	3
E E 201, Networks I.....	3
MATH 291, Calculus and Analytic Geometry III.....	3
MATH 392, Differential Equations.....	3
M E 236, Engineering Mechanics I.....	3
M E 237, Engineering Mechanics II.....	3
M E 240, Thermodynamics.....	3
M E 260, Mechanical Engineering Problem Solving.....	3
PHYS 215, Engineering Physics I.....	3
PHYS 216, Engineering Physics II.....	3

Junior Year (33 credits)

CH E 361, Engineering Materials.....	3
ECON 251G, Principles of Macroeconomics, or ECON 252G, Principles of Microeconomics.....	3
M E 328, Engineering Analysis I.....	3
M E 338, Fluid Mechanics.....	3
M E 340, Applied Thermodynamics.....	3
M E 345, Experimental Methods I.....	3
M E 329, Engineering Analysis II.....	3
M E 326, Mechanical Design.....	3
M E 341, Heat Transfer.....	3
Approved General Education History elective.....	3
Approved Mechanics elective*.....	3

Senior Year (31 credits)

M E 425, Design of Machine Elements.....	3
M E 426, Design Project Laboratory I.....	3
M E 427, Design Project Laboratory II.....	3
M E 445, Experimental Methods II.....	3
M E 449, Mechanical Engineering Senior Seminar.....	1
Approved General Education Human Thought and Behavior elective.....	3
Approved General Education Viewing a Wider World elective.....	3
Approved General Education Viewing a Wider World ECON elective.....	3
Mathematics elective**.....	3
Mechanical engineering electives***.....	6

*Mechanics elective must be taken from M E 331, 332, or 333.

**Mathematics electives must be taken from MATH 391, 471, 472, 473, 480, STAT 371, or I E 310.

***Students in their senior year choose 6 credits of M E electives.

SURVEYING ENGINEERING

Associate Professor Steven Frank*, department head

Professor Reilly (emeritus); **Associate Professor** Burkholder**; **Assistant**

Professor Wurml***; **Adjunct Professors** Maestas*

(505) 646-5375

*Licensed Professional Surveyor in New Mexico

**Licensed Professional Surveyor and Professional Engineer in New Mexico

***Licensed Professional Surveyor and in a state other than New Mexico

DEGREE: Bachelor of Science in Surveying Engineering**MINOR: Surveying Engineering**

Surveying Engineering involves the application of knowledge to the analysis, design, and execution of surveying and mapping projects and the design of land mapping and information systems. Surveyors rely on an understanding of the science of surveying measurement and analysis, the legal principles of boundary location, the laws related to boundaries and land use, and applicable mathematical and computational theories and principles when performing this work. Positional accuracy, land planning and development concepts pertinent to subdivision of land and property surveys, land record and land tenure concepts, as well as earth-related sciences such as geodesy are each a part of professional surveying. Surveying Engineers work for private surveying or engineering firms, for City, County, State or Federal Highway Departments, for State Lands Commissions, for the US Forest Service and for the US Bureau of Land Management.

The mission of the Department of Surveying Engineering is to provide men and women with the rigorous, fundamental education needed to enter and succeed in the surveying and surveying-related professions.

To accomplish this mission, the surveying engineering department will introduce students to the theory and application of recognized surveying principles. Graduates of the program will

- acquire a sound and fundamental understanding of the scientific, mathematical, and engineering principles underlying technology;
- acquire a breadth and depth of education to understand the economic, legal, political, and social context of surveying activities;
- develop the ability to appropriately collect, analyze, interpret, and apply survey and survey-related data;
- develop the ability to recognize, analyze, and solve survey and survey-related problems;
- acquire the verbal and written skills necessary to contribute productively to society;
- acquire an understanding of responsibilities and ethics of surveying professionals;
- develop the ability to work on interdisciplinary teams; and
- recognize the need for and develop the ability to engage in life-long study and learning.

DEGREE: Bachelor of Science in Surveying Engineering (Total Credits 130)**Math and Science Courses (31 credits)**

CHEM 111, General Chemistry I.....	4
GEOL 111G, Survey of Geology, or G EN 260, Geology for Engineers.....	4
MATH 191, Calculus I.....	3
MATH 192, Calculus II.....	3
MATH 280, Linear Algebra.....	3
PHYS 215, Engineering Physics I.....	3
PHYS 215L, Engineering Physics I Lab.....	1
STAT 371, Statistics for Engineers and Scientists I.....	3
Math elective ¹	3
Physics elective ²	4

General Education Coursework (31 credits)

COMM 265G, Principles of Human Communication, or COMM 253G, Public Speaking.....	3
ECON 251G, Principles of Macroeconomics, or ECON 252G, Principles of Microeconomics.....	3
ENGL 111G, Rhetoric and Composition.....	4
ENGL 218G, Technical Communication.....	3
Critical Thinking /Analysis elective.....	3
History elective.....	3
Human Thought and Behavior elective.....	3
Literature or Fine Arts elective.....	3
Viewing a Wider World electives ³	6

Surveying Engineering Coursework (49 credits)

SUR 222, Plane Surveying.....	3
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SUR 285, Photogrammetry.....3
 SUR 292, Public Land Survey System Boundaries3
 SUR 312, Legal Principles of Boundary Surveying3
 SUR 328, Principles and Practices of Construction Surveying3
 SUR 330, Computer Applications of Surveying.....3
 SUR 351, Introductory Survey Measurements, Analysis, and Adjustments....3
 SUR 361, Introduction to Geodesy3
 SUR 401, Ethics and Professionalism in Surveying and Mapping.....3
 SUR 450, Senior Project1
 SUR 451, Advanced Survey Measurements, Analysis, and Measurements ...3
 SUR 452, Land Development Design3
 SUR 461, Introduction to Satellite Geodesy.....3
 Engineering electives⁴9
 Senior elective⁵3

Other Coursework (19 credits)

C E 451, Engineering Economy and Law, or I E 451, Engineering Economy3
 C S 167, C Programming, or E E 161, Computer-Aided Problem Solving3
 GEOG 381, Cartography and GIS.....3
 OEDG 109, Computer Drafting Fundamentals3
 SUR 101, Introduction to Surveying1
 Electives6

¹ Mathematics electives: MATH 291, MATH 377, MATH 391, MATH 392, or MATH 480

² Physics electives: PHYS 216 and PHYS 216L; PHYS 217 and PHYS 217L

³ One Viewing a Wider World elective should come from the College of Business Administration and Economics

⁴ Approved Surveying or Engineering courses

⁵ Senior electives: SUR 410, SUR 412, SUR 462, SUR 464, and SUR 485

⁶ Approved Surveying or Engineering courses, approved business courses, or approved technical courses. Credits should be upper division.

MINOR: Surveying Engineering (24 credits)

GEOG 381, Cartography and Geographic Information Systems3
 SUR 222, Plane Surveying3
 SUR 285, Photogrammetry.....3
 SUR 292, Public Lands Survey System Boundaries3
 SUR 312, Legal Principles of Boundary Surveying3
 SUR 328, Principles and Practices of Construction Surveying (may be substituted by SUR 354, Advanced Plane Surveying).....3
 SUR 361, Introduction to Geodesy3
 Survey elective (any 300 or higher surveying engineering course)3