

**Department of Surveying Engineering  
New Mexico State University**

**Surveying Engineering Student Guide  
2000/2001**

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Welcome to the Department of Surveying Engineering at New Mexico State University. We hope you have great success in completing our program and continuing on to a rich and rewarding career in the surveying profession. This guide is designed to help you begin and continue on the road to success. It contains information about the Surveying Engineering program, the College of Engineering and New Mexico State University that apply to those who wish to complete the Surveying Engineering degree. Please keep this manual handy and refer to it first whenever questions arise. If you cannot find an answer to your question in here, please consult your advisor and we will try to update this guide accordingly. This manual and other information about the Department of Surveying Engineering can also be found on the Internet at <http://www.nmsu.edu/~survey>.

Students should also refer to the NMSU Student Handbook for disciplinary and other general NMSU student policies. The Student Handbook can be found at <http://www.nmsu.edu/%7Evpsa/handbook.html>.

This publication is meant to supplement the NMSU Undergraduate Catalog. Students should also become familiar with the catalog. It is also meant to be a “living” document – subject to addition and change as needed.

The current and previous NMSU catalogs can be found at [http://www.nmsu.edu/Academic\\_Progs/Undergraduate\\_Catalog/](http://www.nmsu.edu/Academic_Progs/Undergraduate_Catalog/).

## **1. Introduction to the Profession of Surveying**

Surveying is the art and science of measuring and locating the positions of objects on or near the Earth's surface. It involves the use of measurement technology, the analysis and solution of technical problems related to measurements, the compilation, analysis, and evaluation of data for mapping purposes, the analysis, evaluation, and solution of legal criteria relating to property boundaries, the design of measurement methodologies, and the design of land subdivisions.

Professional surveyors work with architects, other engineers, real estate agents, and lawyers. Those in private practice perform services for clients, representing those clients before local agency planning boards, and may interact with highway departments, utility companies, and environmental protection agencies. Many professional surveyors work for the federal government in the Cadastral Survey Section of the Bureau of Land Management (BLM), for the US Forest Service (USFS), and for the National Geodetic Survey (NGS). Other professional surveyors may work for oil companies, mining companies, multi-disciplinary engineering firms or large construction firms.

More information about Professional Surveying can be found on the Internet at <http://www.lsrp.com/> and at <http://www.rpls.com/>. Both Internet sites are valuable sources of information about professional surveying.

### **1.1. History of Surveying**

Man has been surveying since the beginning of civilization. Ancient stone survey markers have been found dating back to the Sumerian empire in modern day Iraq. In Ancient Egypt, surveyors used knotted ropes to measure fields for planting after the annual flooding of the Nile. Ancient Egyptian surveyors also helped to align the mighty pyramids of Giza in a true North-South direction. Roman surveyors were responsible for laying out the miles of roads and canals across Europe, some that are still in use today! In the 15<sup>th</sup> through 18<sup>th</sup> centuries, surveyors were mathematicians who computed directions and distances and drew accurate (and thus valuable) maps while accompanying exploration parties from England, Spain, France, Portugal, and the Netherlands. Early surveyors in the United States laid out large tracts of land so that settlers could come in and know where their farms and fields were located.

Modern surveying began in the 19<sup>th</sup> century with the adaptation of optical instruments for survey measurements. In the 1840s, the Society for Chartered Surveyors was founded in England. In 1895, California became the first state to require that surveyors prove their competency and become registered with the state. New Mexico followed suit in 1917, becoming the 4<sup>th</sup> state to require licensure for surveyors.

In recent years, the introduction of computers and satellites has dramatically changed the way surveyors work once more. Global Positioning System satellites coupled with high-speed computers allow us to measure between points located halfway across the world from each other. The combination of computer maps and computer databases has brought forth Geographic and Land Information Systems. Automatic transfer of measurements into computers and the quick and easy manipulation of measurement data into computer-based maps and other survey products have replaced tedious writing of measurements in notebooks.

Land values, once cheap across the United States, have steadily climbed in recent years. With the population growth since World War II, almost all of the easy places to build homes, shopping malls, parks, and highways have been used. New development now calls for solving difficult problems relating to land use and land ownership. Professional Surveyors are being called upon more and more to help solve these problems.

The advancement of technology along with changing ideas and values in land development has spurred the need for greater and better education for Professional Surveyors. Where at one time one could become a Professional Surveyor by working for a long period of apprenticeship under a Professional Surveyor, the explosion of technical and problem-solving knowledge has gone past the capabilities of any one individual. Many states now require that Professional Surveyors obtain a 4-year degree in surveying from a reputable surveying program before they are allowed to become licensed. Many more states are putting in requirements for similar measures. We believe that within the next few years, only those with a 4-year surveying degree will be allowed to become professional surveyors.

## **1.2. Surveying Technicians vs. Professional Surveyors**

As we noted above, there is a strong technical knowledge base needed to become a Professional Surveyor. Those who work for Professional Surveyors may also develop this technical know-how. However, the Professional Surveyors needs to have a strong knowledge-base in the theory of surveying, needs to have good problem-solving skills, and needs to be able to work and communicate effectively with other people in addition to having good technical skills. These are all taught in any good 4-year surveying degree program. One can be trained to become a good technician, able to use measuring devices and computer programs with great skill, but one must be educated, and demonstrate a practical application of that education, to become a professional surveyor.

Technical programs thus focus much more intensively on the operation of instruments and computers. Professional programs, like the Surveying Engineering program at NMSU, spend much less time on technical operations and much more time on developing the knowledge to analyze and evaluate data,

to design measurement solutions for non-routine data collection problems, to evaluate legal evidence for property boundary lines, and to understanding the social and ethical problems related to surveying and land development.

### **1.3. Professional Societies**

Professional societies are made up of members of a particular profession. Some professions, such as law, require that all practicing members of the profession belong to the professional society. Others, such as surveying, encourage, but do not require, membership in a professional society. The professional society is in part responsible for setting the standards of professional practice and ethics. They serve as the collective voice of the profession when dealing with the public, private industry, or government agencies. Membership in a professional society gives the individual practitioner a voice in that society.

There are numerous other benefits to belonging to a professional society, particularly as a surveying student. Professional societies are the greatest supporters of surveying education. They give away local and national scholarship to surveying students, give discount rates for student membership, and discount rates for students attending professional society conferences and workshops.

Applications for membership in many of the following professional societies can be found in the Surveying Engineering department office in Building EC-III, Room 101.

#### **NMPS**

The New Mexico Professional Surveyor's Association (NMPS) is a professional society made up of Professional Surveyors licensed to practice surveying in New Mexico. NMPS is responsible for starting the Surveying program at New Mexico State University. They have an annual conference every year, usually in early spring, and hold local meetings, usually once a month. Student membership in NMPS is free. All a student needs to do to join is fill out an application and have written verification as a surveying student by a Surveying Engineering Department faculty member. Local NMPS chapter meetings are held the 3<sup>rd</sup> Tuesday of the month in Las Cruces. The NMPS Internet site is at <http://www.nmps.org>. There is a link to the NMPS web site on the Surveying Engineering web page.

## **TSPS**

The Texas Society of Professional Surveyors (TSPS) is a professional society of surveyors licensed to practice surveying in Texas. They have an annual conference every year, usually in mid-fall. Student membership in TSPS is available. Local chapter meetings are usually held the 3<sup>rd</sup> Thursday of the month in El Paso. Information and application forms can be found on the Internet at [http:// www.tsps.org/](http://www.tsps.org/). The El Paso chapter of TSPS and the Las Cruces chapter of NMPS have joint meetings in April and December.

## **ACSM**

The American Congress on Surveying and Mapping (ACSM) is a national society made up of professional surveyors and professionals in the mapping field. ACSM is the recognized national surveying society that formulates the policies and guidelines for surveying at the national level. ACSM develops standards for surveying and mapping education, Federal Emergency Mapping Agency (FEMA) surveying and mapping standards, American Land Title Association (ALTA) surveying and mapping standards, and standards for international surveying services under the North American Free Trade Agreement (NAFTA).

ACSM is made up of four member organizations (MOs): the National Society of Professional Surveyors (NSPS); the American Association of Geodetic Surveyors (AAGS); the Geographic and Land Information Society (GLIS); and the Cartography and GIS Association (CAGIS). Students can join any or all of the member organizations for a fee of \$28 per year. Membership includes eligibility for ACSM scholarships, discounts at ACSM conferences, and ACSM journals. ACSM holds two conferences a year, one in the spring, the second in the fall. Some areas of the country have local meetings, but none are held within easy travel distance from Las Cruces. More information can be found on the Internet at <http://www.acsm.net/>.

## **WestFed**

The Western Federation of Surveyors (WestFed) is an organization made up of state surveying societies from 12 western states. Members state organizations include New Mexico as well as Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, Oregon, Washington, and Wyoming. One is automatically a member of WestFed if one is a member of any of these state surveying societies.

## **ASPRS**

The American Society for Photogrammetry and Remote Sensing (ASPRS) is another national society made up of surveyors and mapping professionals. The focus of this society specializes in photogrammetric and remote sensing mapping applications. For many years, ASPRS and ACSM held joint national conferences; however, these joint conferences have become fewer in recent years. More information about ASPRS can be found at <http://www.asprs.org/>.

## **ASCE**

The Geomatics Division of the American Society of Civil Engineers (ASCE) is devoted to Surveying Engineering. Along with ACSM, ASCE shares in setting the standards for surveying education. The ASCE website can be found at <http://www.asce.org/>.

## **F.I.G.**

The International Federation of Surveyors (*Federation Internationale des Geometres* or F.I.G.) is an international organization whose members are the various national surveying societies of each country. ACSM is the recognized national society for surveying in F.I.G. Among issues that F.I.G. are working on are international standards for surveying education. One cannot become an individual member of F.I.G.; however, as a member of ACSM, one is automatically a member of F.I.G. The Department of Surveying Engineering is becoming an Academic Member of F.I.G. More information on F.I.G. can be found at <http://www.fig.net/figtree/>.

## **NCEES**

While not considered a professional society, one other organization is important in the world of surveying and mapping. The National Council of Examiners for Engineers and Surveyors (NCEES) is made up of members from each state and territory. Each NCEES member also serves on a state or territorial board of surveying licensure. NCEES develops the national examinations that are used to test potential surveyors. As discussed below, there are currently two exams that all licensed professional surveyors must take. The first exam is the Fundamentals of Surveying exam. This exam tests the applicant's basic surveying knowledge in surveying and the math and sciences that form the basis for surveying theory. A potential surveyor must pass this exam in order to become a Surveying Intern. Once one has become a Surveying Intern, and fulfilled the necessary requirements of internship, one can take the Professional Surveying exam. This exam focuses on both the knowledge and skills of surveying. The potential surveyor is tested for his or her judgmental and

problem-solving skills as well as his or her knowledge of surveying. More information on NCEES can be found at <http://www.ncees.org/>.

## **ABET**

ABET (formerly called the Accreditation Board for Engineering and Technology) is the major U.S. accrediting agent for engineering and surveying. ABET current accredits approximately 3000 engineering, engineering-related and surveying programs in the US. ABET accreditation is universally recognized as meeting demanding rigors of academic excellence. The surveying profession participates in setting and checking the surveying accreditation standards via the American Congress on Surveying and Mapping (read more under “ACSM”) with input from ASCE.

ABET is divided into three commissions. The EAC sets standards for professional-level engineering and surveying programs. Any degree-granting program meeting the criteria for EAC can apply for EAC accreditation. This includes degree programs that are not a part of a College of Engineering.

RAC oversees engineering-related and surveying programs. While still considered a professional-level accreditation, the math and science rigors are less than those of EAC. The name of the RAC may be changed to the Applied Science Commission (ASC).

TAC is the Technical Accreditation Commission. TAC oversees 2 year and 4 year engineering, engineering-related and surveying programs. TAC accredited graduates are presumed to be non-professional level technicians, however many, but not all, states do allow TAC accredited graduates to become licensed professional engineers or surveyors.

Key criteria to meeting either EAC or RAC standards are student’s abilities to solve complex, professional-level problems and instructor’s qualifications as licensed professional surveyors or as recognized specialists in the fields that they teach. These abilities and qualifications are not a part of the TAC criteria.

Degree granting programs must demonstrate that their graduates can perform at entry-level professional positions. For this reason we recommend that all seniors apply for and take the Fundamentals of Surveying exam. Passing this exam will set you on the next step past graduation towards your career in the surveying profession. You can read more about the Fundamentals of Surveying exam under “FS Exam.”

More information on ABET can be found on the Internet at <http://www.abet.org/>.

#### **1.4. Becoming a Professional Surveyor**

It is not necessary to become licensed to be considered a Professional Surveyor. However, certain surveying services require that one be licensed by a state licensing board. State licensing boards exist to make sure that surveys are performed competently in order to guard the interests of both the client and the public. If you decide to work for a large mining company, and are only surveying within the interior of the mining claim, without ever surveying the boundaries, you will not need to be licensed in most, if not all, states.

Professional Surveyors are licensed or registered by a State Board of Registration. Each of the 50 states and US territories has a Board of Registration in one form or another. Only by qualifying with education, experience, and good personal character will one be allowed to become licensed in any state or territory. Exactly what constitutes the practices of professional surveying varies from state to state. The National Council of Examiners for Engineers and Surveyors (NCEES) have developed a Model Law for surveying that is slowly becoming adopted by various states.

There are normally several steps to becoming a licensed or registered Professional Surveyor. First, one must become a Surveying Intern by taking and passing a Fundamentals of Surveying (FS) exam. This exam is developed by NCEES and passing the FS exam in one state is usually sufficient for another state to recognize one as a Surveying Intern. Some states, such as Texas, will recognize the passing of the FS exam in another state but may still require additional paperwork. The FS exam is administered by each state and territory through its board of registration. The FS exam is an eight-hour exam. Applications for the FS exam can be obtained from the Surveying Engineering department office.

The next step is to serve as a Surveying Intern working under the direction and supervision of a licensed or registered Professional Surveyor for a given period (four years in New Mexico, two years in some states, more than four years in others). When one has served sufficient time as an intern, he or she may apply to take the Professional Surveying (PS) exam. This is usually an eight-hour exam. The board of registration will review the application, ascertain that sufficient expertise appears to have been gained, and grant permission to take the Professional Surveying exam. A portion of the PS exam, usually 4 to 6 hours, is a "national" exam developed by NCEES. The remaining section will contain questions and/or problems related to state specific surveying laws, regulations, or practices.

So what is needed to become a Professional Surveyor? First, a 4-year surveying degree from a recognized program is highly advised. Those with a degree from a program recognized by ABET as being professional-level surveying programs should have no trouble becoming a Professional Surveyors

anywhere in the United States (or in other places around the world, for that matter). States that do not require a 4-year degree still require several years working under the direction of a Professional Surveyor and most, if not all, will allow the 4 years spent getting a surveying degree to count as 4 years of experience.

You can find the licensing laws and regulations for most states on the Land Surveyor Reference Page at <http://www.lsrp.com/>. Look under the “Main Menu,” then look under “Land Surveying Rules, Regulations, Statutes by State.”

### **Fundamentals of Surveying Exam**

Second, all states require an internship period of 2 or more years after receiving a 4-year degree (New Mexico requires 4 years of internship before one can apply to become a Professional Surveyor). To start this internship, one must pass the Fundamentals of Surveying (FS) exam and become certified as a Land Surveyor in Training by his or her state. In New Mexico, students in the Surveying Engineering program are allowed to take this exam during their senior year or after they graduate. Actual internship for students who pass the FS exam begins with graduation. Internship for those who have already graduated begins after they pass the FS. Normally, time spent after graduation and before passing the FS will not be counted towards internship.

During the internship period, the LSIT must work under the direction of a Professional Surveyor. The LSIT should be performing at greater responsibility levels during his or her internship. Each applicant’s internship work scope and responsibility levels are carefully scrutinized by the Board of Registration. If the Board determines that the applicant has met the experience requirement, he or she is allowed to take the Practice of Surveying (PS) exam. Passing the PS exam, along with good character references from other Professional Surveyors, is needed to become a Professional Surveyor.

However, it does not stop with becoming a Professional Surveyor. You must continue throughout your professional career to stay up-to-date on technology, problem-solving techniques, legal statutes and regulations, and public concerns.

**Becoming a Professional Surveyor is a life-long commitment to excellence, personal responsibility, and public service.**

## **2. Department of Surveying Engineering**

The Department of Surveying Engineering at NMSU was created in 1990. It is one of 13 currently accredited professional-level surveying degree programs in the United States. The Department is currently accredited under the RAC guidelines for ABET (formerly the Accreditation Board for Engineering and Technology). Please read the "ABET" section of this guide for more information about ABET. We are applying for EAC accreditation in the Fall of 2000. Both RAC and EAC are professional-level accreditation levels, however EAC accreditation applies the full rigor of engineering math and science to the surveying program. It is our belief that students graduating from an EAC program will be better prepared for the rigors of professional surveying and thus able to command both higher salaries and higher positions than RAC graduates. We realize that much of the success in any professional career comes from the individual abilities of that professional, but we believe we have given graduates a higher level of knowledge in which to use his or her ability.

Our teaching philosophy is to prepare students for a professional-level career in surveying. We do this at three levels. First, we concentrate on developing an understanding of the underlying theories and technologies that support surveying practices. Second, we introduce lab exercises and homework designed to show the practical applications of those theories and technologies. Finally, we try to develop an understanding of how to use these practical applications to solve complex problems in surveying practice. This third level is what we believe separates professionals from technicians in the field of surveying. We expect the majority of our graduates to be able to perform at professional levels in surveying within 5 years after graduation.

### **2.1. Surveying Engineering Faculty**

There are three full-time faculty members in the Department of Surveying Engineering: Department Head (and Professor) James P. Reilly, Associate Professor Steven Frank, and Associate Professor Earl F. Burkholder. In addition, Adjunct Instructor Thomas Maestas assists with surveying labs.

Dr. James P. Reilly has been with the Department of Surveying Engineering since 1990. Dr. Reilly has a BS in Mining Engineering from Penn State University and a MS and PhD In Geodetic Science from Ohio State University. Dr. Reilly has taught previously in the Surveying Program at Iowa State University. Dr. Reilly is the President-elect of the American Congress on Surveying and Mapping.

Dr. Steven Frank has been with the Department of Surveying Engineering since 1994. Dr. Frank has a BS and MS in Surveying Engineering from CSU Fresno and a PhD in Surveying Engineering from the University of Maine. He is a Licensed Professional Surveyor in New Mexico and California. His specialty

areas are boundary surveying, land subdivision, construction surveying, and professional ethics. He spent 10 years as a surveying technician before moving up to the professional level of surveying. He has worked for both local government and private industry in and about Sacramento, California, has had his own surveying practice, and has worked in Saudi Arabia. He is currently the President-elect of the New Mexico Professional Surveyor's Association, a member of the board of the American Association of Geodetic Surveyors, and serves on several professional surveying society committees.

Earl F. Burkholder is registered as both a Professional Surveyor and a Professional Engineer in New Mexico. He has been with the Department of Surveying Engineering since 1998. Professor Burkholder has taught previously in the Surveying Program at Oregon's Institute of Technology. He has a BS in Civil Engineering from the University of Michigan and a MS in Civil Engineering (Geodesy) from Purdue University.

Thomas Maestas is a full-time employee of the Cadastral Survey Section of BLM where he has worked for over 15 years. He received his BS in Civil Engineering Technology from NMSU. Thom's expertise is in boundary surveying. He primarily teaches the USPLSS lab. Because of Thom's status as a BLM surveyor, many of his lab projects are conducted as part of actual BLM survey projects.

## **2.2 Students**

Students are expected to be able to work hard, think critically, and accept the major responsibility for their education. Studies show that in a typical university or college course about seventy percent of what students learn, they learn through their own initiative by reading, watching and participating in class homework and lab exercises. Another twenty percent is learned through interaction with other students. The remaining ten percent is learned directly from the instructor.

The student population in the Department of Surveying Engineering is diverse, coming not only from the State of New Mexico, but from across the U. S. and from overseas. The small size of the department gives it a "family" atmosphere that is often missing in larger departments. Many graduates remark that this is an asset that the Department of Surveying Engineering should not lose.

Students are expected to be able to find entry-level employment in a surveying or surveying-related job upon graduation. Although many entry-level jobs in surveying are at the technician level, graduates are expected to quickly climb to professional-level position. For this reason, the professional-level aspects of surveying are stressed along with the technical skills and knowledge needed to become a productive member of the surveying profession. These professional-

level aspects include critical thinking, problem solving, ethical understanding and understanding the professional surveyor's role in society.

### **2.3 Facilities**

The Department of Surveying Engineering is temporarily housed in various rooms in the Engineering Complex III. According to College of Engineering plans, the Department of Surveying Engineering will eventually be housed in Engineering Complex I. The Departmental office is located in Building EC-III, Room 101. There is a survey equipment storage room, a photogrammetry lab room, and a computer lab room controlled by the Department. In addition, the Department has access to the College of Engineering computer lab room to teach computer-based lab sessions. Those survey lab exercises that do not require computers are nearly all performed out of doors. Some lab exercises are performed off-campus.

### **2.4 Equipment**

The Surveying Engineering Department tries to keep up with changes in technology, but having the "latest and greatest" software and surveying equipment is not always possible. The Surveying Engineering Department philosophy is to educate professions, not to train technicians to become expert instrument operators or draftspersons. At the same time, we realize how important it is for students to have "hands-on" practice of what they have been learning. Many Surveying Engineering courses do have required lab work or projects that require understanding and using appropriate software and equipment. The Department is constantly looking for ways to get "newer and better" equipment, but there is also an expectation that students will treat all equipment with the respect and care they would if they personally owned it. Surveying Engineering lab equipment is available outside of lab hours for students wanting extra practice or to use it in a small project on a case-by-case basis.

### **Field Equipment**

The Department has three (3) total station theodolites (with both digital angle and distance measuring capability) that can be used for automated data collection. There are both SMI and TDS data collection technology available to use with these. There are seven (7) semi-total stations, which cannot be used for automated data collection. There are sufficient stand-alone theodolites (without EDM capability) for all lab sessions. The Department also has some older transits, alidades, and EDMs that are used primarily to help teach surveying history and concepts.

The Department has seven (7) single-frequency Trimble Global Positioning Satellite (GPS) receivers of surveying quality in addition to two (2) hand-held GPS units useful for rough location. The Department has been able to borrow Real-time Kinematic (RTK) GPS technology on a case-by-case or prearranged basis with local surveying firms and agencies.

The Department has numerous automatic levels and has recently acquired a digital level that can be used for precise leveling.

### **Computers and Software**

The Department currently has 18 student computers available plus access to the College of Engineering computer lab with another 26 computers. The Surveying Engineering lab is located in EC III, Room 105 (enter through the Surveying Engineering office) and the COE computer lab is located in EC I, Room 210A. All computers are hooked up to the Internet. Due to current spacing limits, not all of the Department computers are hooked up at this time.

The Department has access to both AutoCad and TerraModel drafting software. Both can be found in the COE computer lab. Terramodel is also available on the computers in the Surveying Engineering lab. Access to TerraModel requires a software key available from Dr. Frank. The version of AutoCad used is Release 13. The COE has decided not to upgrade to newer AutoCad software because of costs. Students may get a student version of AutoCad in the Student Bookstore in Corbett Center. This version has a limited lifetime and will automatically expire at a certain date.

The Department has StarNet least-squares computing software. This will be made available in both the COE and Surveying Engineering labs. Access to StarNet requires a software key available from Professor Burkholder.

The Department has ArcView GIS software in both computer labs. This software does not require a key. There is a CalComp 36" x 48" digitizing table with an older version of AutoCad. There is also a HP 455C laser plotter (36" width) available as well as conventional laser printers for plotting drawings.

### **3. Surveying Engineering Degree Requirements**

To graduate with a degree in Surveying Engineering you **MUST** fulfill every requirement of your catalog. Students graduating under newer catalogs may find that they have different requirements than students graduating under older catalogs. This happens as the Department continually improves the Surveying Engineering program. The long-term goal of the Department is to allow students flexibility while ensuring a rigorous education. In addition, courses themselves continually change. Students must be aware of changes in course numbers and contents. If you have questions, ask your advisor.

#### **3.1 NMSU General Education Requirements**

The philosophy for requiring general education is described by NMSU as follows:

General education attempts to foster intelligent inquiry, abstract logical thinking, critical analysis, and the integration and synthesis of knowledge; it strives for literacy in writing, reading, speaking, and listening; it teaches mathematical structures, acquainting students with precise abstract thought about numbers and space; it encourages an understanding of science and scientific inquiry; it provides a historical consciousness, including an understanding of one's own heritage as well as respect for other peoples and cultures; it includes an examination of values and stresses the importance of a carefully-considered values system; it fosters an appreciation of the arts; and general education provides the breadth necessary to have a familiarity with the various branches of human understanding.

Flowing from this philosophy, the following objectives were identified. Students who successfully complete the general education requirements will:

Be able to think critically.

Be able to integrate and synthesize knowledge.

Demonstrate literacy in reading, writing, and oral communication.

Be familiar with mathematical structures.

Understand science and scientific inquiry.

Have a historical consciousness, including an understanding of his/her own heritage.

Have an appreciation for the arts.

Be familiar with the various branches of human understanding.

The general education program is comprised of a total of thirty eight (38) credit hours distributed as follows:

- I. Developing Critical Thinking and Modes of Expression
  - A. English Composition – Engl 111G and Engl 218G\*
  - B. Mathematics – Math 191\*
  - C. Information Retrieval\*\*
  - D. Critical Thinking/Analysis – Comm 265G\* and Phil or CS elective\*\*\*
  
- II. Establishing a Common Background
  - A. Historical perspectives – elective from catalog
  - B. Basic Natural Sciences – Geol 111G\*\*\*
  - C. Human Thought and Behavior – elective from catalog
  - D. Social Analysis – Econ 251G\*
  - E. Literature or Fine Arts – elective from catalog
  
- III. Viewing a Wider World
  - Two electives from catalog

More information on NMSU General Education requirements can be found at <http://www.nmsu.edu/~gened/>.

\*The College of Engineering requirement for general education

\*\* Requires a research paper.

\*\*\* Surveying Engineering requirement

### **Repeating a Course**

Any course number lower than 300 may be repeated for a grade if the grade being replaced is a D or a F. If a student has achieved a grade of C or better, the course may NOT be repeated for a higher grade.

### **Academic Probation/ Academic Suspension**

If a student's grade point average falls below 2.0, the student and the department will be notified that the student has been put on "Academic Probation." The student MUST increase his or her grade point average to 2.0 or higher in the following semester. Failure to do so may result in "Academic Suspension."

A student who does not maintain an acceptable grade point average may be suspended – not allowed to take courses at NMSU. Normally, a first time academic suspension is only for one semester. Subsequent academic suspensions may be for one year or longer.

Refer to the NMSU Undergraduate Catalog under "Academic Standing" or [http://www.nmsu.edu/Academic\\_Progs/Undergraduate\\_Catalog/ch1/regulations.html](http://www.nmsu.edu/Academic_Progs/Undergraduate_Catalog/ch1/regulations.html).

## **3.2 NMSU College of Engineering Requirements**

Certain general education courses are required for College of Engineering majors. These courses are noted in the “General Education Requirements” listed above.

### **Engineering “D” Rule**

1. To maintain the quality of the program, students must pass any lower division engineering, mathematics, and science course with a C or better.
2. Likewise, students must pass any prerequisite course with a C or better before taking any course requiring the prerequisite.
3. Students must retake lower division or prerequisite coursework in engineering, mathematics, and science courses for which a D is earned until such time that they earn a C or better in these courses.
4. A transfer D in engineering, mathematics, and science courses will not be allowed to count toward the degree requirements.

### **3.3 ABET EAC requirements**

Graduates must demonstrate:

- (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 function on multi-disciplinary teams
- (e) An ability to identify, formulate, and solve engineering problems
- (f) An understanding of professional and ethical responsibility
- (g) An ability to communicate effectively
- (h) The broad education necessary to understand the impact of engineering solutions in a global and societal context
- (i) A recognition of the need for, and an ability to engage in life-long learning
- (j) A knowledge of contemporary issues
- (k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

These program criteria apply to engineering programs including "surveying" and similar modifiers in their titles:

### **1. Curriculum**

The program must demonstrate that graduates have competency in one or more of the following areas: boundary and/or land surveying, geographic and/or land information systems, photogrammetry, mapping, geodesy, remote sensing, and other related areas.

### **2. Faculty**

Programs must demonstrate that faculty teaching courses that are primarily design in content are qualified to teach the subject matter by virtue of professional licensure or by educational and design experience.

## **3.4 Incoming Freshman Degree Requirements**

Incoming freshmen may be placed directly in the Surveying Engineering program if they meet the College of Engineering entrance requirements. Students with one deficiency are labeled "General Surveying Majors" and have one year to make up that deficiency. Students with more than one deficiency will need to make up coursework before becoming accepted as a Department of Surveying Engineering student. The Dona Ana Jr. College is located on the NMSU campus and provides most, if not all, courses needed to correct academic deficiencies.

## **Catalog**

Any entering freshman must use the catalog of record at the time of his or her start of courses at NMSU. This is the catalog listing the requirement that must be met to reach graduation. No student may graduate under a catalog that is more than six (6) years old. Students who quit school and come back to finish up at a later date are also subject to this rule. Any student may upgrade his or her catalog up to and including the catalog in effect at the time of his or her graduation.

## **3.5 Transfer Student Degree Requirements**

### **Non-degree transfer students**

Transfer students without a four-year degree from an accredited institution will have their transcripts evaluated by the NMSU Registrar's office. This usually takes 2-3 months, depending on the number of transcripts to be reviewed in that office. Surveying courses are evaluated in the Department of Surveying Engineering by faculty consensus.

### **Second degree transfer students**

Transfer students who have a four-year degree from an accredited institution will NOT have their transcripts evaluated by the NMSU Registrar's office (this policy may change in the future). All courses are evaluated in the Department of Surveying Engineering by faculty consensus. Second degree students must still meet overall catalog requirements for general education and ABET criteria.

## **Catalog**

The catalog of record is the catalog in current use upon the transfer student's first active semester in the Department of Surveying Engineering. Students transferring from other programs at NMSU may use the catalog they started at with NMSU, provided that no student shall use a catalog more than six (6) years old as of the date of planned graduation. Students who quit school and come back to finish up at a later date are also subject to this rule. Any student may upgrade his or her catalog up to and including the catalog in effect at the time of his or her graduation.

## **Transfer Course Evaluations**

NMSU Department of Surveying Engineering faculty will evaluate surveying courses for all incoming transfer students and all courses for incoming transfer students seeking a second four-year degree. The criteria for accepting courses for transfer credit by the Department of Surveying Engineering are as follows:

- 1) Courses accepted by the NMSU Registrar's office for non-degreed students will also be accepted for second degree students; the Surveying Engineering Department reserves the right to reject transfer classes that have been incorrectly evaluated by the Registrar's office;
- 2) The course being transferred must be taught by a comparable department at another institution (e.g. math courses must be taught by the Math Department, English courses by the English Department, etc.);
- 3) The course content must be reasonably comparable to the course required by the NMSU Department of Surveying Engineering;
- 4) The course prerequisites must be reasonably comparable the course prerequisites required by NMSU and the NMSU Department of Surveying Engineering.
- 5) The Engineering D Rule applies to all transfer credits.

### **3.6 Course Substitution Guidelines**

Courses substitutions are rare and require PRIOR approval of the Department of Surveying Engineering. Courses transferred from another college or university may be substituted as outlined in the previous section on “Transfer Course Evaluations.” Other methods of acceptable course substitution are as follows:

**Surveying Engineering Courses:** No surveying courses may be substituted EXCEPT when a particular course is no longer taught. However, surveying engineering courses may be challenged by examination with the PRIOR permission of the Department of Surveying Engineering.

**Other courses:** Certain coursework may be substituted upon DOCUMENTED work showing proficiency in the subject being substituted. For example, a student may document substantial work as a drafting technician using AutoCad or a similar computer-aided drafting software and be allowed to substitute another course in place of the CAD course requirement. The course MUST be replaced with the same number or more credits approved by the Department of Surveying Engineering. Courses used for substitution must contribute towards the student’s general knowledge of surveying.

### **3.7 Graduation**

Students must apply to graduate and pay graduation fees in the semester in which they plan to graduate. Failure to apply for graduation in time will result in the student not graduating. Consult the Undergraduate Catalog for more information on graduation forms and fees.

The College of Engineering has a special graduation ceremony, called “Sociedad de Ingenieros,” which is held the Friday evening prior to NMSU graduation ceremony. All engineering students are encouraged to attend and to bring their family and friends. The Sociedad de Ingenieros is much smaller than the NMSU ceremony, thus allowing family and friends to see and recognize you as well as take photos.

## 4. Financial Assistance Information

Financial assistance can be found in many forms: grants, student loans, work-study, and scholarships are the most common. They are also available from many sources: federal government, state government, local government, private foundations, professional associations, private companies, and New Mexico State University. Many students use a combination of loans, work-study, and scholarships to help finance their NMSU education.

Most financial assistance programs give awards based on academic achievement and financial need. Some programs have a residency requirement. Many programs require academic monitoring and failing, withdrawing from, auditing, or repeating a course more than twice may seriously harm your eligibility. Allowing your grade point average (GPA) to fall below 2.0 may also harm your eligibility. Most programs require completion of a degree within 12 semesters. You may also have requirements to be enrolled half- or full-time to keep your eligibility.

If you receive financial assistance through NMSU, you will need to set up an account in the NMSU Business Office. Funds from federal and state assistance programs will be deposited into your NMSU account and outstanding bills will be automatically deducted. If you have received outside financial assistance, the amount of that assistance may also be deducted from your account.

It is important to note that financial assistance for students relies upon students able and willing to complete requirements. Students who repeatedly fail or withdraw from classes or who do not maintain a decent GPA may lose, be asked to make early repayment on, or be asked to give back their financial assistance.

### 4.1. Student Grants and Loans

Information about student grants and loans can be found by calling the NMSU Financial Aid Office at 505-646-4105. The website for the office can be found at <http://www.nmsu.edu/finaid>. The website lists eligibility requirements for the various student loan programs offered at NMSU. Grants are normally not repayable IF the student fulfills all of the conditions of the grant.

You can find out more about which federal, government programs you are eligible for by filling out a *Free Application for Federal Student Aid* (FAFSA) form. You can download a FAFSA form at <http://www.fafsa.ed.gov>. More information about various federal assistance programs can be found at <http://www.ed.gov/offices/OSFAP/Students>. You should be aware that some federal assistance programs will deduct other forms of financial assistance from your federal funds (e.g. if you win a scholarship for \$500, you may receive \$500 less on your federal student grant or loan).

## 4.2. Work-study

Work-study is a form of financial assistance where a student receives financial assistance in return for work. You must fill out a FAFSA form to become eligible for work-study. You can work up to 20 hours a week on campus or off campus for a nonprofit community service organization. Under work-study, the employer pays a portion of the student's salary while the federal or state government pays the remainder. Most of the eligibility rules are the same as if receiving a student loan. Up to \$2,800 per year may be earned under work-study.

Crimson Scholars work-study funds are special work-study funds set aside for Crimson Scholars.

## 4.3. Scholarships

If you graduated from a New Mexico high school, you may be eligible for a New Mexico lottery scholarship. These scholarships are available at several levels, based on high school academic achievement and financial need. You will be automatically considered for some scholarships as an incoming freshman IF you take the ACT before January 1 and are admitted to NMSU by March 1. More information on NMSU scholarships can be found at <http://www.nmsu.edu/~finaid/>.

The College of Engineering has many scholarships available. Students must fill out an application and will be automatically considered for all scholarships for which they are eligible. COE scholarship forms may be obtained from EC I, Room 128, or by calling 505-646-3547. Minimum academic qualifications normally require at least a 2.5 GPA and many are reserved for 3.0 GPA and higher students. Surveying Engineering students qualify for any general engineering scholarships offered through the College along with all other Engineering majors. Certain scholarships are reserved specifically for Surveying Engineering students. Scholarship application may be turned in at any time; however scholarship selection is normally made during the summer or early fall. A current listing of these scholarships is given below:

- Thomas Mann, Sr. Memorial Scholarship -- \$500
- New Mexico Profession Surveyors Scholarship -- \$500
- BLM Cadastral Surveyor Scholarship -- \$330
- Center for Surveying Ethics Studies Scholarship -- \$400
- Mesilla Valley Maze Scholarship -- \$500

The following scholarships are available through surveying professional societies. All typically require official copies of student transcripts and letters of recommendation. The NMSU Surveying Engineering faculty is always ready to write letters of recommendation for current students and graduates of the Surveying Engineering program. Some also require a letter of intent, e.g. the

student's career plans and goals after graduation. More information on NMSU College of Engineering scholarships can be found at <http://www.nmsu.edu/~coe/Student-Services/scholar.html>

The New Mexico Professional Surveyors Association has several \$500 scholarships it will be awarding. Applications may be obtained from the Surveying Engineering office or from the NMPS website at <http://www.nmps.org>. These scholarships are separate and distinct from the NMPS scholarships offered through the College of Engineering. The scholarships are normally awarded at the NMPS Annual Conference held in Albuquerque, NM, in February or March. NMPS also will give financial assistance to students wishing to attend the conference.

The American Congress on Surveying and Mapping (ACSM) offers several scholarships. Applicants MUST be members of ACSM (student membership dues are \$28/year). Awards are given out at the ACSM Annual Convention. This year's conference will be held in Las Vegas, Nevada. ACSM and the ACSM/NMSU Student Chapter can give some financial assistance to those wishing to attend the ACSM Conferences. Scholarship applications are normally due December 1 for consideration in the following year. You will be notified approximately 3-4 weeks before the conference as to whether you have been awarded a scholarship. Scholarship information and forms can be found at <http://www.acsm.net> or in the Surveying Engineering office.

The Western Federal of Surveyors (WestFed) also has several scholarships available. Applications for WestFed scholarships can be found in the Surveying Engineering office. Notices will be posted when the applications arrive.

The American Society for Photogrammetry and Remote Sensing has scholarships available. Scholarships applications can be found in the Surveying Engineering office. Notices will be posted when the scholarship forms arrive. Due dates for scholarships is normally December 1. Scholarship information and forms can be found at <http://www.asprs.org/>.

New scholarship information will be made available as it is received. Scholarship announcements are also typically made at ACSM/NMPS Student Chapter meetings.

#### **4.4. Out-of-state Programs**

Normal out-of-state tuition is 3 times in-state tuition. However, several programs exist to allow qualified students to attend NMSU at lower tuition rates.

Texas residents living within a 135-mile radius of the NMSU campus are eligible to attend NMSU at in-state tuition rates. This limit includes all of El Paso County and Hudspeth County up to Van Horn. Other in-state tuition programs are

available. For more information, call the NMSU Admissions Office at 505-646-3121 or 1-800-662-6678.

There are Alumni Out-of State scholarships available for students. More information can be found on the <http://www.nmsu.edu/finaid> website.

New Mexico is a part of the Western University Exchange (WUE) program. Students living in a state participating in WICHE are eligible to attend a college or university in any other WICHE state at 1.5 times in-state tuition.

## **5. What you need to be successful in the Surveying Engineering program**

Several factors seem to contribute to student success in the Surveying Engineering program at NMSU. Having reliable equipment, finding the right study group, and having an enthusiasm and interest in courses are possibly the 3 biggest factors.

### **5.1. Computing Equipment**

We recommend that you investigate buying a HP48GX calculator. This calculator is NOT required, however it is a standard in the surveying profession. If you have another calculator that you are comfortable with, you will still be successful in the program. We also recommend that you acquire a home computer running at least Windows '95. If you have a Mac or dos-based computer, you will still be successful in the program. However, almost all of our labs and exercises are designed with the HP48GX and Windows applications. Read the section on "Computers" to learn more about the Department's computer capabilities and policies.

We also recommend that you purchase a personal computer with Internet access. We are starting to use web-based materials in our course instructions and while these are always available from school computers, school computers are not always available to students. You can request access to a computer lab in the Surveying Engineering department and we are always happy to honor legitimate requests.

### **5.2. Attendance, Homework, etc.**

In order to learn, you must be present, must make sure you understand and can perform the exercises assigned by the instructor and take personal responsibility for learning the materials covered. A large part of being a Professional Surveyor involves the willingness to take personal responsibility for one's actions. We believe that this personal responsibility begins in the classroom with each student taking responsibility to be the major contributor to his or her education. Studies show that most of what a student learns is because of a personal commitment to learn. In addition, working in an environment with other students allows new ideas to be explored, values to be questioned, problem-solving abilities to be enhanced, and interpersonal skills to become developed.

Studies also show that people learn in many different ways. We try to accommodate different learning styles, but need to know if our teaching styles are compatible with your individual learning styles. We will try to do evaluations during the semester and at the end of each semester to get feedback from students so we can improve our teaching methods. You are also encouraged to approach any faculty member during the semester for help with materials, better understanding concepts, or other problems during the semester.

If you have poor study habits, you are encouraged to take UNIV 110 courses to improve your habits. While not counted towards your degree, these courses may contribute to your long-term success.

### **5.3 Academic Misconduct**

#### **Plagiarism**

You are encouraged to work with other students, to share ideas and concepts, to try to find understanding of the concepts and problems posed. However, answers and solutions **MUST** be of your own work. You are reminded that plagiarism is an offence subject to academic disciplinary action. Plagiarism is the copying and submittal of other's work as one's own. If you are unsure about what constitutes plagiarism, consult your NMSU Undergraduate Catalog, see [http://www.nmsu.edu/Academic\\_Progs/Undergraduate\\_Catalog/ch1/regulations.html](http://www.nmsu.edu/Academic_Progs/Undergraduate_Catalog/ch1/regulations.html) under "Academic Misconduct," or see your academic advisor.

#### **Disruptive Students**

If a student is disruptive in class, he or she will be informed by the instructor that their behavior is inappropriate, that it will not be allowed in class, and that further disruptive behavior will be grounds for disciplinary action. The instructor will write a memo to file detailing the incident.

If a student is disruptive in a second class meeting, the instructor will remind the student of the prior warning and tell the student that disciplinary action will be initiated as a result of the second incident. The student may be asked to leave the classroom. The instructor may then write to the Judicial Hearing officer, documenting all nonacademic violations that have occurred. Copies will be sent to the Surveying Engineering Department Head and the Associate Dean of Engineering.

If behaviors are extremely disruptive, dangerous, or threatening, the Judicial Hearing Officer may be contacted on the first offense. If the situation warrants, the instructor may call the University police. (Source: NMSU Administration Office).

## **6. Opportunities**

Education enhances a person's intellectual capacity and enables each person to compete more successfully in a local, state, national, and global economy. As William Butler Yeats put it, "Education is not the filling of a pail, but the lighting of a fire." Our goal is to help each person realize individual dreams, but each dream is fulfilled by the graduate and is measured by each graduate's contribution to society.

The degree in Surveying Engineering from New Mexico State University is but a stepping stone towards a rich and rewarding career. Graduates will need to engage in the pursuit of life-long study to continually enhance their careers and maintain awareness of issues and technological advances affecting surveying.

We hope that each and every one of you is successful in the career you develop with your Surveying Engineering degree from New Mexico State University.