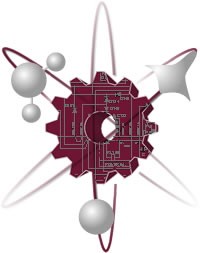
**Self-Study Report**

**for the**

**Engineering Physics Program**

**(Bachelor of Science in Engineering Physics)**

****

**at**

**New Mexico State University**

**Submitted by:**

**Engineering Physics Program**

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**Las Cruces, NM 88003-8001**

****

**2018**

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# BACKGROUND INFORMATION

The mission of *Engineering Physics (EP) Program* at *New Mexico State University (NMSU)* is to offer an accredited degree that combines high-quality engineering and physics programs to best prepare our graduates for careers in state-of-the-art industry or to move on to advanced study in in physics or an engineering discipline.

## A. Contact Information

*List name, mailing address, telephone number, fax number, and e-mail address for the primary pre-visit contact person for the program.*

The main contact for the *Engineering Physics Program* is:

Dr. Heinz Nakotte

Chair of the Engineering Physics Program Committee

Department of Physics

New Mexico State University

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Las Cruces, New Mexico 88003

Phone: (575) 646-2459

Fax: (575) 646-1934

E-mail: [hnakotte@nmsu.edu](mailto:hnakotte@nmsu.edu)

Dr. Nakotte is the current Chair of the *Engineering Physics (EP) Program Committee*, which administers all aspects of the program. The *EP Program Committee* has members from the *Department of Physics* (*College of Arts & Sciences*) and the *Departments of Mechanical & Aerospace Engineering*, *Chemical & Materials Engineering* and *Electrical & Computer Engineering* (*College of Engineering*).

The primary contact for EP program in the *College of Engineering* is:

Dr. Sonya Cooper, Ph.D., P.E.

Associate Dean of Academics

College of Engineering, MSC 3449

New Mexico State University

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Las Cruces, NM 88003-8001

Phone: (575) 646-2912

Email: [socooper@nmsu.edu](mailto:socooper@nmsu.edu)

Fax: 575-646-3549

## B. Program History

*Include the year implemented and the date of the last general review. Summarize major program changes with an emphasis on changes occurring since the last general review.*

For more than 50 years, the *Department of Physics* has offered the traditional physics degrees, i.e. *Bachelors of Science (BS)*, *Masters of Science (MS)*, and *Doctorate of Philosophy (PhD)*. By the 90s, most of the emphasis of the physics programs had been on the graduate degrees, and the BS was designed mostly to prepare students for advanced graduate studies in Physics.

At the same time, however, the *Department of Physics r*ecognized a steadily increasing demand for students with a more applied undergraduate degree, especially for industry and national laboratories. In response, the *Department of Physics* implemented two new degrees: first, a *Bachelor’s of Arts (BA)*, which requires a minor in a second field (popular minors are Astronomy, Chemistry or Mathematics, and later, a *Bachelor’s of Science in Engineering Physics (BS-EP)* degree. In addition, the Department of Physics also offers a Minor in Physics.

The EP degree was proposed in 2001 with two concentrations, one in *Mechanical Engineering* and one in *Electrical Engineering*, and separate curricula for these EP concentrations were developed jointly with the corresponding engineering departments. This Self Study Report focusses on the BS-EP degree. The EP program was internally approved and placed in *NMSU’s Undergraduate Catalog* for the first time in 2002. In 2004, EP celebrated its first graduate, who had switched his major from physics to EP.

About 5 years after introduction of the EP program, the *Department of Physics* filed for its first accreditation of the EP program with ABET, and it was successfully accredited in 2007. Following ABET accreditation, the EP program added two additional concentrations, one in *Aerospace Engineering* and another in *Chemical Engineering*, in response to needs and demands from program constituents. Like the original concentrations, the respective curricula were developed in close consultation with the corresponding engineering departments. The EP program and all four of its current concentrations were successfully re-accredited by ABET in 2013.

EP is not one of traditional engineering disciplines; there were fewer than 20 ABET-accredited programs nation-wide when the program was first introduced at NMSU. On the other hand, the demand for graduates with a background in EP continues to grow and therefore several other institutions have introduced EP programs seeking accreditation since then. EP is generally considered as one of the most challenging degree programs in academia; however, the potential rewards are very high, as indicated by the quote from *The Princeton Review®*:

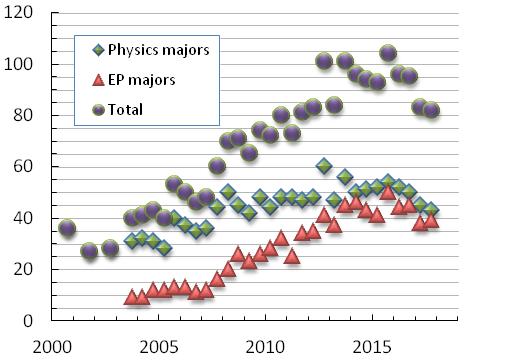
*It might seem like engineering physics is someone’s idea of a cruel joke —combining two of the toughest majors into one. But no pain, no gain, my friend! And gains in this field come in the form of a wide blanket of job opportunities and—if you play your cards right—a nice-looking starting salary.*

After accreditation by ABET in 2007, the EP program at NMSU started growing at an average of ~5 students per year. As shown in Diagram 0.1, this trend continued until 2015, after which the enrollment seems to have settled around 40 students. In Fall of 2017, the enrollment in EP at NMSU totaled 39 students, which is comparable to the number of physics BS and BA majors combined.

While the EP program has among the lowest enrollments among all engineering programs at NMSU, it produces high-quality graduates who typically have little trouble securing rewarding career opportunities or getting admitted to advanced graduate programs after graduation (see *Criterion 2 – Program Educational Objectives*).

Another indicator for the quality of the EP program are the strong retention and graduation rates. Table 0.1 lists the retention and graduation rates for incoming EP freshman since Fall of 2008. This may be largely attributed to more individual attention and guidance provided to students in low-enrollment programs. It should also be noted that EP students who left EP typically switched majors to a pure physics or an engineering major, which is to be expected when freshman/sophomore EP students develop a stronger affinity to either pure sciences or more applied engineering subjects. In other words, while those students appear in the minus column for EP retention, they are not lost in the overall retention statistics of the colleges, i.e. *Arts & Sciences* for physics majors and *Engineering* for engineering majors. Similarly, students who switched majors from other engineering degrees to EP are not included in either program-specific retention statistics.

**Diagram 0.1.** Enrollment of Physics and Engineering Physics majors since 2000.



**Table 0.1.** Retention and Graduation Statistics for incoming EP freshman since 2008.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Semester** | **Number of Incoming Freshman EPs** | **Number of Freshman EPs graduating after 4 years** | **Number of Freshman EPs graduating after 5 years** | **Number of Freshman EPs graduating after 6 years** | **Total Freshman EPs Retained** |
| *Fall 2008* | 4 | 2 | 1 |  | 3 (75%) |
| *Fall 2009* | 7 | 1 | 2 |  | 3 (42.6%) |
| *Fall 2010* | 2 |  |  |  | 0 (0%) |
| *Fall 2011* | 6 | 1 |  | 1 | 2 (33.3%) |
| *Fall 2012* | 8 | 3 | 1 |  | 5 (62.5%)a |
| *Fall 2013* | 3 |  |  |  | 3 (100%) |
| *Fall 2014* | 5 |  |  |  | 4 (80%) |
| *Fall 2015* | 14 |  |  |  | 11 (78.6%) |
| *Fall 2016* | 9 |  |  |  | 7 (77.8%) |

a: One EP student is still in the program and on track to graduate in 2018

### EP Program Organization

The EP program at NMSU is a program supported and co-administered by the colleges of *Engineering* and *Arts & Sciences*. It is supported by four mature departments – *Physics* (*College of Arts & Sciences*), *Electrical & Computer Engineering* (*College of Engineering*), *Mechanical & Aerospace Engineering* (*College of Engineering*) and *Chemical & Materials Engineering* (*College of Engineering*).

EP is a program in the *Department of Physics*, which belongs to NMSU’s *College of Arts & Sciences*. The *Department of Physics* receives its annual budget allocations from the *College of Arts & Sciences*, and the department utilizes the budget to support all of its academic programs: the *MS* and *PhD in Physics*, the *BS* or *BA in Physics* and the *BS in Engineering Physics*. The *Department of Physics* receives some additional support from the *College of Engineering* through its allocations of the *Engineering Fee*.

EP is an engineering degree and therefore administered by NMSU’s *College of Engineering*. The *College of Engineering* oversees all academic issues of the EP program, including accreditation, curricular issues, and program quality.

Both colleges benefit from the across-college EP degree. The *College of Engineering* benefits in that the program is fully supported financially through the *Department of Physics* in the *College of Arts & Sciences*. The *College of Arts & Sciences* benefits as the EP program secures sufficient enrollment for a healthy overall physics program.

The EP program itself is run by an *EP Program Committee*, which consists of members from the *Departments of Physics* (*College of Arts & Sciences*) and the Departments of *Mechanical & Aerospace Engineering*, *Chemical & Materials Engineering* and *Electrical & Computer Engineering* (*College of Engineering*). The EP Committee oversees all program issues, including curricula, program evaluation & growth etc. Current members of the *EP Program Committee* are given in Table 0.2. The organizational chart of the EP program is given in Diagram 0.3.

**Table 0.2.** Members of the Engineering Physics (EP) Program Committee – 2017/2018

Dr. Heinz Nakotte (Chair), Professor, Department of Physics

Dr. Thomas Hearn, Associate Professor, Physics

Dr. Steve Pate, Professor, Physics

Dr. Igor Vasiliev, Professor, Physics

Dr. Mike DeAntonio, College Professor, Physics

Dr. Young-Ho Park, Associate Professor, Mechanical & Aerospace Engineering

Dr. Steve Stochaj, Professor, Electrical & Computer Engineering

Dr. Hongmei Luo, Associate Professor, Chemical & Materials Engineering

Dr. Stefan Zollner, Department Head, Department of Physics (*ex officio*)

Dr. Sonya Cooper, Associate Dean for Academics, College of Engineering (*ex officio*)

**Diagram 0.2.** Organizational Chart of the Engineering Physics (EP) program at NMSU.



Of the 39 EP majors enrolled in Fall 2017, 7 classify as freshmen, 7 as sophomores, 9 as juniors and 16 as seniors within the university system. It should be noted that university-level classification strictly depends on credit hours taken and/or transferred. In other words, high-school students admitted from dual-credit programs or with *Advanced Placement (AP)* credits or transfers from junior colleges are often classified at a higher level than would be inferred by the semester that the students join the EP program. Since the EP program tends to attract the stronger high-school graduates, a more meaningful classification based on the starting semester yields the following distribution: 11 freshmen, 12 sophomores, 7 juniors and 9 seniors. NMSU in an accredited minority-serving institution, and this is reflected also in EP enrollment: A total of 62% of the EP students enrolled in Fall 2017 are self-declared minorities: i.e. of the 39 EP students, 21are self-declared Hispanic, 2 are self-declared American-Indian and 1 is a self-declared African-American.

## C. Options

*List and describe any options, tracks, concentrations, etc. included in the program.*

The title of the degree awarded is *Bachelor of Science in Engineering Physics* and there are currently four different concentrations: the *Aerospace*, *Chemical*, *Electrical* and *Mechanical Concentrations*.

In 2016, NMSU decided to reduce the requirement of minimum credit hours for a degree from 128 to 120 with the goal of increasing graduation rates. After careful consideration, the *EP Program Committee* (see Table 0.2.) decided that the EP could not really decrease its minimum credit hours without adversely affecting the program quality and still fulfilling the various other requirements, including those for ABET accreditation, the state-mandated general-education and the university-level *Viewing-the-Wider-World (VWW)* requirements.

The current requirements for all EP concentrations are listed in the *2017-2018 Undergraduate Catalog*, and they are briefly summarized in the following sections.

The *Aerospace Engineering (AE) Concentration* of the EP program requires a total of 130 credit hours, which consist of 15 credits in the State of New Mexico Common Core areas IV and V, 6 credits in VWW courses, 14 credits in Mathematics, 10 credits in English and Communications, 4 credits in Chemistry, 33 credits in Physics (12 of which have significant engineering content), 3 credits in General Engineering, 3 credits in Civil Engineering, 12 credits in Mechanical Engineering, 27 credits in Aerospace Engineering, and 3 credits of an Engineering Design Capstone.

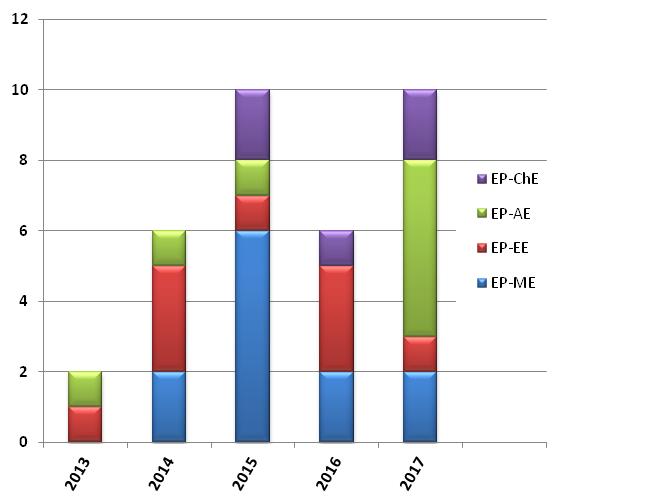
The *Chemical Engineering (CE) Concentration* of the EP program requires a total of 132 or 133 credit hours, which consist of 15 credits in the State of New Mexico Common Core areas IV and V, 6 credits in VWW courses, 14 credits in Mathematics, 10 credits in English and Communications, 11 credits in Chemistry, 39 credits in Physics (15 of which have significant engineering content), 3 credits in General Engineering, 28 credits in Chemical Engineering, 3 credits of a Technical Elective (with engineering content), and 3-4 credits of an Engineering Design Capstone. EP students with the Chemical Concentration can either take the 4-credit capstone in the Chemical Engineering Department of a 3-crcdit capstone in any other engineering department.

The *Electrical Engineering (EE) Concentration* of the EP program requires a total of 130 or 131 credit hours, which consist of 15 credits in the State of New Mexico Common Core areas IV and V, 6 credits in VWW courses, 14 credits in Mathematics, 10 credits in English and Communications, 4 credits in Chemistry, 42(39) credits in Physics (12 of which have significant engineering content), 3 credits of General Engineering, 27(31) credits in Electrical Engineering, 3 credits of a Technical Electives (with engineering content), and 6 credits of an Engineering Design Capstone. EP students with the Electrical Concentration can opt to take *EE 351 to* satisfy the *PHYS 462* requirements.

The *Mechanical Engineering (ME) Concentration* of the Engineering Physics program requires a total of 129 credit hours, which consist of 15 credits in the State of New Mexico Common Core areas IV and V, 6 credits in VWW courses, 14 credits in Mathematics, 10 credits in English and Communications, 4 credits in Chemistry, 36(33) credits in Physics (12 of which have significant engineering content), 3 credits of General Engineering, 3 credits of Civil Engineering, 29(32) credits in Mechanical Engineering, 3 credits of a Technical Elective (with engineering content), and 6 credits of an Engineering Design Capstone. EP students with the Mechanical Concentration can opt to opt to take *ME 333* (significant engineering content) to satisfy the *PHYS 451* (no significant engineering content).

Of the 39 EP students enrolled in Fall of 2017, the most popular concentration was the *Mechanical Concentration* with 16 students, followed by the *Aerospace Concentration with* 12, then the *Electrical Concentration* with 8, and the *Chemical Concentration* with 3. A similar trend in preferences for EP concentrations is seen also in the graduation over the past five years, see Diagram 0.3.

**Diagram 0.3.** Annual graduation rates of EP students and their concentrations.



## D. Program Delivery Modes

*Describe the delivery modes used by this program, e.g., days, evenings, weekends, cooperative education, traditional lecture/laboratory, off-campus, distance education, we-based, etc.*

The EP program is a face-to-face program with some co-op options. All the courses are offered during daytime hours, Monday through Friday, and are intended primarily for full-time or nearly full-time students. Students also have the option of summer sessions for some of their beginning level courses.

Except for the capstone design projects, course and laboratories are typically taught using traditional teaching approaches. Capstone design courses require students to be involved some major design project. In general, the students will work in (sometimes interdisciplinary) teams of 3-5 students. In general, EP students will participate in capstone projects offered through different engineering departments. Participating departments will provide the necessary budget and the space needed to complete a capstone project. In many cases, capstones are done in collaboration with industrial partners, and those might provide some of the needed funding. Occasionally, students may propose their own capstone project, which are sponsored and supervised by individual faculty members. In all cases, students are expected to give presentations on the progress of a project, to participate in formal design review sessions and to write a final design document. It is common that physics faculty members are involved in the evaluation process of final-design presentations of projects that involve EP students.

## E. Program Locations

*Include all locations where the program or a portion of the program is regularly offered (this would also include dual degrees, international partnerships, etc.).*

Lecture courses and teaching laboratories utilize lecture halls, classrooms and laboratory facilities that are available at the participating departments, i.e. *Gardiner Hall* in the case of *Department of Physics*, *Jett Hall* in the case of the *Department of Chemical & Materials Engineering* as well as the *Department of Aerospace & Mechanical Engineering*, *Thomas Brown Hall* and *Goddard Annex* in the case of the *Department of Electrical & Computer Engineering*. Program-specific requirements in *Mathematics* and *Chemistry* are typically held in *Science Hall* and the *Chemistry Building*, respectively. General-education, *VWW* and other courses are held all over campus in buildings that house the support department which offer the course or in big lecture halls, such as *Hardmann Hall*.

## F. Public Disclosure

*Provide information concerning all the places where the Program Education Objectives (PEOs), Student Outcomes (SOs), annual student enrollment and graduation data is posted or made accessible to the public. If this information is posted to the Web, please provide the URLs.*

Program Educational Objective, Program Outcomes, student enrollment and graudation data are made available to the public through links at http://engineeringphysics.nmsu.edu/.

## G. Deficiencies, Weaknesses or Concerns from Previous Evaluation(s) and the Actions Taken to Address Them

*Summarize the Deficiencies, Weakness, or Concerns remaining from the most recent ABET Final Statement. Describe the actions taken to address them, including effective dates of actions, if applicable. If this is an initial accreditation, it should also be indicated.*

The last ABET site visit for the EP program took place at NMSU between October 14-16, 2012. The initial assessment of the *EP Program Reviewer* indicated one weakness in *Criterion 5 – Curriculum* and one concern in *Procedures and Policies*.

The initial assessment of a weakness related to whether all concentrations of the EP program provide an equivalent of one and one-half years of engineering topics. The problem arose mostly because the EP program failed to clearly indicate and justify which of the physics courses can be counted toward the engineering contingent and which cannot. Following the initial assessment, the *Department of Physics* submitted a clarification to ABET and Table 5.1. In the *Final Statement of Accreditation* from ABET, dated August 12, 2013, this initial weakness was downgraded to an observation. It read: *‘At the time of the visit, there was some confusion as to which courses the program intended to include in the one and one-half years of engineering topics. It is entirely appropriate for technical electives to be included in the engineering topics component, but it is very important that the choices available for students to include in this component have content that is clearly engineering topics, not basic science. The program could improve the clarity of its documentation by clearly identifying the engineering topics component.’*

Physics courses are obviously a major component of any EP program. Naturally, every physics course is expected to consist of fundamental-science components, the underlying concepts and the theoretical models, and this may raise concerns whether such any of those courses can be counted toward the engineering contingent. Some (but not all) physics courses do include engineering applications at some level. On the other hand, it is usually up to the instructor of a course to what extend current or potential applications are covered. In consultation with course instructors, the EP Program Committee identified the physics courses, for which expectations of significant engineering components are most reasonable; see *Criterion 5 – Curriculum*. Instructors of the identified courses are informed about such additional expectations.

The initial assessment of a concern in *Procedures and Policies* was deemed a weakness in the *Final Statement of Accreditation*. The concern/weakness raised was: *‘The Accreditation Policy and Procedure Manual section II.A.6. requires that each accredited engineering program must be specifically identified as accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org. The engineering physics website does not identify the program in this manner. In addition, Section II.G.6.b.(1) requires that the instructional and learning environments be adequate and safe for the intended purposes. At the time of the visit the program facilities did not have Materials Safety Data Sheets on display. Also, the Physics Education Research Laboratory is used to store certain senior design projects that are developing laboratory demonstrations. However, this space is also used in conducting outreach to pre-college students, which could expose the pre-college students to safety hazards. The program lacks strength of compliance with the Accreditation Policy and Procedure Manual.’*

Corrections to the EP program’s webpages were already made at the time of the 2012 ABET site visit and they were found to be complying by ABET staff. In addition, a policy was implemented requiring that all hazardous materials and safety hazards are removed from laboratories before a visit from pre-college students. Accessibility to MSDS data sheets for all chemicals is provided as required by OSHA guidelines. All students and employees who work in the program laboratory are informed of the location during the site-specific HAZCOM training. The weakness was found to be resolved.

# CRITERION 1. STUDENTS

*For the sections below, attach any written policies that apply.*

The following sections are outlined according to *University* (1), *College* (2), and *Department/Program* (3) requirements, where applicable.

## A. Student Admissions

*Summarize the requirements and process for accepting new students into the program.*

### A.1. University (NMSU 2017-2018 Undergraduate Catalog)

Requirements for admission as a first-time degree seeking student include the following:

* A formal application for admission, accompanied by a one-time $20 nonrefundable application fee.
* An official transcript with the student’s high school credits is to be sent directly from the high school to the *Undergraduate Admissions Office*. Students who attended a college or university while in high school must request official transcripts(s) sent directly to the *Undergraduate Admissions Office* by the *Registrar* of each college or any post-secondary educational institution previously attended, you may hand carry the official sealed and unopened school envelope to our office.
* Official results of the *American College Testing Program (ACT)* or *Scholastic Aptitude Test (SAT)* are to be sent directly from the *Testing Centers* to the *Undergraduate Admissions Office*. All freshman applicants are required to submit scores from either the *ACT* or the *SAT* before a final admission is granted.

**Freshman Admission Requirements**

Students who meet the minimum high school course requirements listed below must meet one of the following criteria in order to be admitted:

* Cumulative high school GPA of 2.75
* Ranked in the top 20 percent of their graduating class
* *ACT* composite score of 21 or *SAT* score\* of 990 (*SAT* score of 1060 for new format)

\*NMSU uses combined scores from the critical verbal and math portions of the *SAT* for admission and scholarship purposes. NMSU will be taking scores from the traditional *SAT* and the new *SAT* format, which was launched March 2016.

*Note: All entering freshmen must submit official ACT or SAT scores before final admission is granted. ACT code 2638, SAT=4531*

| Minimum High School Requirements | |
| --- | --- |
| **Subject** | **Units** |
| English | 4\* |
| Math | 4\*\* |
| Science | 2\*\*\* |
| Foreign Language/Fine Art | 1 |

*\*Must include at least 2 units of writing intensive courses, one of which must be a junior or senior level course  
\*\*From Algebra1, Geometry, Algebra II, and one additional math course  
\*\*\*Beyond general science*

Applicants who meet all the requirements listed above will be admitted to NMSU. An applicant who does not meet all the requirements may also be admitted if a review of their additional information indicates that the student would be successful at NMSU.

We encourage all students to apply for admission to NMSU. When reviewing the admissibility of students, we consider many factors, including high school GPA, test scores, dual-credit coursework, leadership experience, community involvement and other accomplishments. Applicants may be asked for additional information, including academic letters of recommendation, in support of their application.

See <https://catalogs.nmsu.edu/nmsu/essential-information-students/admissions/> for application instructions for GED, HISET, Home School, Non-degree seeking, and Re-admission students.

### A.2. College of Engineering (*NMSU 2017-2018 Catalog*)

The College uses the *University Admissions Requirements*. In addition, the following procedures are enforced:

For regular admission to the *University* and the *College of Engineering*, incoming freshman and transfer applicants must meet the University's qualifications for regular admission as stated in the undergraduate catalog in effect at the time of application. Students admitted to the *College of Engineering* will be classified by the college as a pre-major until the standard requirements described below for admission to the program major are met.

Pre-major students will be admitted into their respective programs once they have met the following criteria:

Earn a minimum grade of C- in all of the following courses:

| **Course** | **Title** | **Credits** |
| --- | --- | --- |
| [CHEM 111G](https://catalogs.nmsu.edu/search/?P=CHEM%20111G) | *General Chemistry I* | 4 |
| or [CHEM 11](https://catalogs.nmsu.edu/search/?P=CHEM%20111G)5 | |  |
| [ENGL 111G](https://catalogs.nmsu.edu/search/?P=SPCD%20111G) | *Advanced ESL Composition* | 4 |
| [ENGR 100](https://catalogs.nmsu.edu/search/?P=ENGR%20100) | *Introduction to Engineering* | 3 |
| [MATH 191G](https://catalogs.nmsu.edu/search/?P=MATH%20191G) | *Calculus and Analytic Geometry I* | 4 |
| PHYS 213 | *Mechanics* | 3 |
| or [PHYS 215G](https://catalogs.nmsu.edu/search/?P=PHYS%20215G) | *Engineering Physics I* | |

Any of the above courses with earned *AP* credit (minimum score of 3) is exempt from the list. Transfer students may meet this criteria with determined passing credit of equivalent courses. Pre- major students will be advised by the *Center for Academic Advising and Student Support (CAASS)*.

NMSU’a *College of Engineering* reserves the right to independently test any student’s English proficiency upon arrival, including those who have earned scores satisfying minimum admission criteria. If the demonstrated level of English proficiency is not sufficient for academic success as determined by the *Center for English Language Programs*, support classes may be required to improve proficiency.

### A.3. Engineering Physics (EP) Program

The *Department of Physics* uses no additional admission requirements for the admission to the Engineering Physics (EP) program beyond the *University* and *College Admission Requirements*

## B. Evaluating Student Performance

*Summarize the process by which student performance is evaluated and student progress is monitored. Include information on how the program ensures and documents that students are meeting prerequisites and how it handles the situation when a prerequisite has not been met.*

### B.1. University

**Student Performance Assessment**

Individual student performance and learning outcomes in a course are measured and evaluated by the course instructor and reported to the student in the form of grades. Each instructor has the authority to establish assignments and other assessments (such as exams and quizzes) and to assign grades based on the student’s performance on those assessments. Final grades for the course are determined by the instructor and reported to the *University Registrar* as described in grading section of this catalog.  Any student who believes that their academic performance has been evaluated unfairly may appeal the grade through the *University’s Academic Appeals Process* as provided in this Catalog.

***Midterm* and *Six-Week Early Performance Grades***

A *Six-Week Early Performance Grade* (sometimes referred to as *Midterm Grade*) for courses numbered 100-299 will be posted and available to students through the *MyNMSU* portal. The purpose of the early grade posting is to ensure that students have an opportunity to address any performance issues.  Students should be mindful that the *Six-Week Early Performance Grade* reflects a student’s performance on only that portion of the total coursework that has been graded at that time. Any student who is doing poorly, or not as well as they would like, should meet with the instructor to discuss how they can improve. Students who have concerns about their progress in multiple courses or who are considering withdrawal from course(s) must meet with their academic advisor.

In courses numbered 300 or higher, the posting of *Early Performance Grades* is optional and may occur through the online course management system rather than the *MyNMSU* portal.  However, prior to the last day to withdraw from a course, upon request, instructors will provide information to students about their progress in the course.

**Undergraduate *Academic Standing***

When a student does not maintain adequate academic standing, he/she is placed in *Academic Warning*. If the student's academic standing does not improve, the placement progresses to *Academic Probation I*. Continued unimproved academic standing moves a student into *Academic Probation II*, then finally, *Academic Suspension*. Each stage imposes more structure and limitations on the student to help them return to normal academic standing. The intent is not to punish, but to help the student return to normal academic standing and success. Since some of these limitations involve limitations on the number of credit hours, students on *Probation* or *Suspension* may be subject to loss of financial aid. It is the responsibility of the student to determine the impact of their changed academic standing on their financial aid. Notification to students of academic warning, probation, or suspension appears on the student’s grade report at the end of each grading period.

**Undergraduate *Academic Warning***

This is issued only once, the first time a student's cumulative GPA falls below a 2.0, while in good academic standing. The relevant *Associate Dean for Academics* or *Campus Academic Officer (CAO)* will send the student a letter detailing the consequences should the cumulative grade point remain below a 2.0 after the semester. A student on *Academic Warning* remains eligible for all extracurricular activities as governed by the rules of the specific activity.

While under *Academic Warning* the following restrictions apply:

The student may be required to enroll in a 3-credit hour special study skills/time management course specifically designed for students on *Academic Warning*, or an equivalent course approved by the appropriate *Associate Dean* or *CAO* of their campus.

Students will be required to enter into a contract with their advisor, approved by their department head that places further stipulations on *Academic Warning*. The contract may include, but is not limited to the following:

The student may be required to take at least one repeat course to try to improve their GPA.

Except for the special study skills/time management course, the student’s coursework may be restricted to their major.

The student may be required to get tutoring help.

The student may be required to see an academic counselor on a specified time schedule.

The number of credit hours a student may register for may be restricted (due to extenuating circumstances such as the student’s workload commitments).

The *Associate Dean or CAO* may place the student on *Academic Probation I* should the student not adhere to the stipulations of the contract.

If the student’s semester GPA is less than a 2.0, and the cumulative GPA remains below a 2.0 at the end of the semester on Academic Warning, the student is placed on Academic Probation I. If the semester GPA is greater than 2.0 but the cumulative GPA is still less than 2.0, the student will remain on *Academic Warning*. If the cumulative GPA is greater than a 2.0 at the end of the semester then the student is returned to good academic standing.

**Undergraduate *Academic Probation I***

This occurs when a student under *Academic Warning* has a semester GPA less than 2.0, and the cumulative GPA remains below 2.0 after the semester or if the student maintains a semester GPA greater than 2.0 while on *Academic Probation I* but the cumulative GPA is still less than 2.0.

Under *Academic Probation I* the following conditions apply:

The student cannot enroll in more than 13 hours of coursework during the semester. *Note: Students falling below 12 credits in any one semester will jeopardize their financial aid.* Should this occur, students should see the associate dean in their college as soon as possible to try to implement corrective measures.

The student will enter into a contract or individualized education plan with their advisor and approved by the *Associate Dean* or *CAO* that place further stipulations on Academic Probation I. The *Associate Dean* or *CAO* may place the student on *Academic Probation II* or *Academic Suspension* should the student not adhere to the stipulations of the contract.

Students on *Academic Probation* receiving educational benefits from the *Veterans’ Administration* must obtain counseling from the *Military & Veterans Programs Office*.

Students admitted under special provisions whose transcripts indicate less than a 2.0 GPA are admitted on *Academic Probation I*.

The student must maintain a semester GPA equal to or greater than 2.0 until such time that the cumulative GPA is greater than 2.0 at which time the student goes back to good academic standing. Until the transition happens the student remains on *Academic Probation I*. The student will be placed on *Academic Probation II* if he/she is unable to maintain a 2.0 semester GPA, and the cumulative remains below a 2.0 GPA, while under *Academic Probation I*. A student on *Academic Probation I* remains eligible for all extracurricular activities as governed by the rules of the specific activity.

**Undergraduate *Academic Probation II***

*Academic Probation II* is issued in two ways.

The first is when a student falls below a semester 2.0 GPA and the cumulative GPA remains below a 2.0 while on Academic Probation I.

The second is when a student maintains a semester GPA greater than 2.0 while on Academic Probation II but the cumulative GPA is still less than 2.0.

The following restrictions are in place for student's in *Academic Probation II*:

The student cannot enroll in more than 7 credit hours of coursework during the semester.

As with rule 2 under *Academic Warning* and *Academic Probation I* and at the discretion of the *Associate Dean or CAO*, the student will be required to enter into a contract with their advisor, approved by the *Associate Dean or CAO*, to place further stipulations on *Academic Probation II*.

The *Associate Dean or CAO* may place the student on *Academic Suspension* should the student not adhere to the stipulations of the contract.

The student must maintain a semester 2.0 GPA or higher until the cumulative GPA reaches a 2.0 or higher at which time they are placed on good academic standing. A student unable to maintain a semester GPA of 2.0 or higher, and the cumulative remains below 2.0 GPA, while under *Academic Probation II* will be placed on *Academic Suspension*. A student on *Academic Probation II* remains eligible for all extracurricular activities as governed by the rules of the specific activity.

**Continuing in *Probationary Status***

Students may continue to enroll while on *Academic Probation I or II* provided they maintain a semester GPA of 2.0 or higher. If they withdraw from the university while on *Academic Probation*, they continue that same level of *Academic Probation*.

**Removal of *Academic Probation***

Such academic standing is removed when the cumulative GPA is raised to 2.0 or higher, with the following exceptions:

* a transfer student may not remove probation by summer work alone;
* if an I grade is removed after the student has enrolled, the new grade’s effect on academic standing is based on its inclusion with grades for the term for which the student is enrolled;
* exercise of the *Adjusted Credit Option* does not change academic status until subsequent grades are earned.

***Academic Suspension***

When a student does not achieve a semester 2.0 GPA or higher, and the cumulative remains below a 2.0 while under *Academic Probation II*, they are placed on *Academic Suspension*. Students under *Academic Suspension* are not allowed to take NMSU courses while under suspension. Students on *Academic Suspension* must sit out a minimum of 1 semester and then petition the Provost or designee to be removed from *Academic Suspension*. At this time, the suspension status will be evaluated for possible removal. Should the suspension be lifted, the student is placed on *Academic Probation II* until the cumulative GPA equals or exceeds a 2.0. At the discretion of the Provost or designee, the student will enter into a contract approved by the Provost or designee and the student’s *Dean* or *CAO*, setting stipulations to have the suspension removed. Failure to adhere to the contract will return the student to *Academic Suspension*.

Under certain conditions, a student may be re-admitted at NMSU under regular status while under *Academic Suspension* when satisfactory progress has been demonstrated at another college or university (see Readmission- Degree Seeking). Credits earned at another university or college while under *Academic Suspension* from NMSU or another university or college will be accepted at NMSU only after the student demonstrates satisfactory progress over a period of two semesters after being re-admitted or admitted to NMSU. Acceptance of transfer credits that count toward degree requirements is still governed by the rules established by the student’s respective college or campus.

### B.2. College of Engineering

Starting in Fall 2015, the *Freshman Year Experience (FYE) Program* implemented a structured intervention program based on students’ six-week performance grades. The *College of Engineering* relied on the ENGR 100 peer mentors to execute the structured intervention plan and in Fall 2016 data was collected on the overall success of the peer mentor academic interventions. Once the six-week performance grades are posted, the mentors are provided with a list of the mentees who are considered “at-risk”. Students who have at least one C or below were required to attend an “intervention session” with their peer mentor. A student who has two C’s or below grades are required to see their peer mentor once a week for two weeks, a student with three C’s or below was required to see their mentor once a week for three weeks. The program manager conducts a training for the mentors to discuss their role in implementing an intervention for their mentees. Mentors first schedule an appointment with the mentee to discover the root cause of the low performing grade. Once the mentor and mentee determine the root of the problem they develop a success plan. Mentors are also required to document the type of interaction they have with their mentee and make judgements about the progress of their mentees. Mentors provide academic tutoring, academic advice, college adjustment recommendations and much more during their intervention sessions.

The results from the interventions are very positive. For example, there was a total of 49 students who were required to meet with their mentor for an intervention. Out of the 49 students, 36 met with their mentor at least once, and 89% of those students saw a grade improvement from their six-week performance grade to their final grade. In addition, 67% of the students meet with their mentor two or more times and 92% of those students received a higher final grade. As the results show, the more frequently a mentee met with their mentor the more likely they were to improve their final grade.

### B.3. Engineering Physics (EP) Program

**Monitoring Student Progress**

The EP program evaluates student performance by measuring Student Outcomes as defined in *Criterion 3 – Program Outcomes*. Documentation of continuous improvement based on evaluating program outcomes can be found in *Criterion 4 – Continuous Improvement*.

NMSU utilizes a software package called *STAR (Student Academic Requirements)* as the main advising tool to track student progress. *STAR* provides up-to-date progress monitoring and degree audits that can be accessed by each student individually, their advisors and staff members, who have been granted access. All degree programs offered by the *Department of Physics* (including EP) are available on *STAR*.

Using *STAR*, students and/or advisors select the appropriate college (and campus), major and an appropriate catalog year. *STAR* audits are placed into the queue and are typically completed in minutes. Each audit provides a detailed list of completed courses and open requirements, given a catalog year for the chosen major. *STAR* provides a detailed summary of student performance, including GPA, individual course grades (both, within and outside of the student’s major) and an itemized list of satisfied or unsatisfied requirements. *STAR* also provides a list of courses that still need be taken toward graduation, if applicable. Once approved, substitutions, exceptions or waivers are also reflected in *STAR*.

An additional advising tool is the flowcharts for each EP concentration, which are shown in *Criterion 5 - Curriculum.* The flowcharts visually show a proposed schedule for degree completion in 4 years, including all pre-requisite and co-requisite requirements for each course. The flowcharts are used to guide the student through the degree program and provide them with a list of the courses required as well as what course sequence is recommended.

**Meeting Pre-requisites**

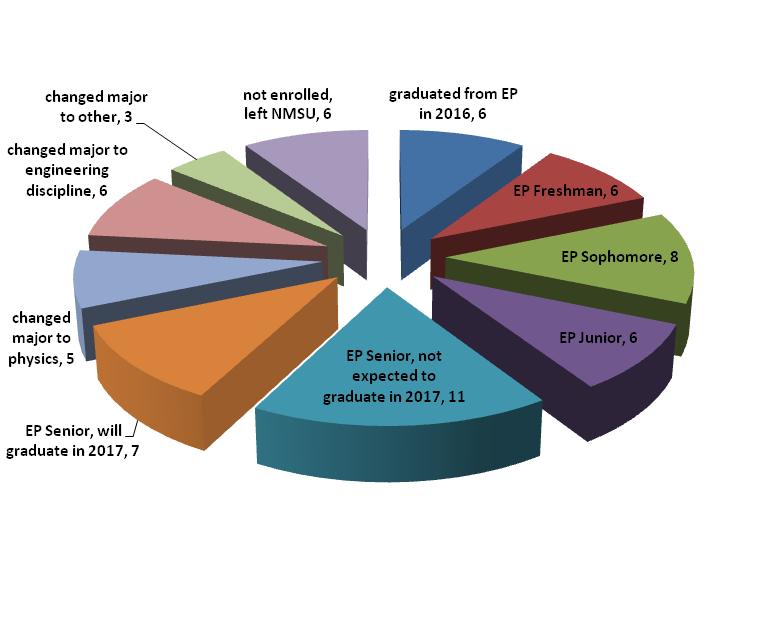
NMSU uses a system called *Banner* for the student enrollment into courses. This software has a built-in list for making sure students have met the proper pre-requisite requirements to take a course. The pre-requisite lists are prepared by the department and submitted to the *Registrar’s Office*, where it is entered into the degree-program database. If a student attempts to register for course, for which he/she has not met the prerequisite requirement(s), *Banner* will flag the class and notify the student that pre-requisite requirements are not met.

On occasion, waiving a pre-requisite is unavoidable and a student will request a waiver for a pre-requisite. For example, a transfer student may need to have a pre-requisite requirement removed or a student could not take the pre-requisite in a timely fashion because of time conflicts with other classes in the previous semester(s). Students are encouraged to talk to their advisor to explore all possible alternative options. If a pre-requisite waiver is indeed necessary, the students or the advisor can petition with the instructor to waive pre-requisite requirements for a course.

### Retention

There are two student societies in the Department of Physics: The *Society of Physics Students (SPS)* and the *Society of Engineering Physics Students (SEPh).* Both societies are provided with space in the *Department of Physics* building (*Gardiner Hall*) and the department hosts and supports many of their activities. The current *President of SPS is* Rachel Ridgeway, the *President of SEPh* is Juan Treto. In addition, each society has two faculty advisors (*SPS:* Drs Lauren Waszek and Robert Cooper, *SEPh:* Drs Michael DeAntonio and Heinz Nakotte), at least one of whom will participate in their weekly meetings throughout the semester. Both societies play an instrumental role in the department’s retention efforts, and they are also involved in many of the department’s recruitment activities.

The *Department of Physics* holds annual meetings involving all faculty members to discuss the progress of every single undergraduate student enrolled in different majors, including EP. Students that are ‘in trouble’ (failing grades, inadequate course enrollments or similar) are contacted individually by their respective advisors, who will discuss with those students how to best approach and correct their individual situation.

The *EP Program Committee* keeps track on previously enrolled EP student who transfer to a different program or withdraw from the university and tries to contact them to understand what led to the student’s decision to leave the program. Such information is used as additional input for improvement of the overall program. Diagram 1.1. shows some of the retention data prepared for the *External Engineering Physics Advisory Board* (see *Criterion 2* *– Educational Objectives*) meeting in Spring of 2017. Of the 64 students that were enrolled as EP at any time between *Fall of 2015* and *Spring 2017*, 44 students (69%) were still in EP in Spring of 2017.

**Diagram 1.1.** Classification and Retention of EP students (Fall of 2015 - Spring of 2017)

## C. Transfer Students and Transfer Courses

*Summarize the requirements and process for accepting transfer students and transfer credit. Include any state-mandated articulation requirements that impact the program.*

### C.1. University (NMSU 2017-2018 Catalog)

NMSU evaluates eligible courses for NMSU transfer equivalency from postsecondary institutions that are regionally accredited or are candidates for regional accreditation. Credits from non-accredited institutions may be evaluated after the student has shown acceptable performance at NMSU for two semesters of full time enrollment.

Transfer students are subject to the same graduation requirements as all NMSU baccalaureate-degree (bachelor's) seeking students. Thirty (30) of the last 36 credit hours for every degree to be awarded from NMSU must be earned at NMSU.

**Community/Junior College Transfers**

Community/Junior College transfer students may be admitted and classified based on acceptable credits earned at a two-year institution. However, transfer students are subject to the same graduation requirements as all NMSU-Las Cruces campus baccalaureate seeking students. This includes the required minimum number of 48 upper division credits from courses numbered 300 or above and the requirement that the last 30 credits must be earned through this university.

*Note: Students currently enrolled at a NMSU Community College (Alamogordo, Dona Ana, Carlsbad or Grants) are not considered transfer students. If a student wants to change campuses they must submit a* [*Change of Campus*](https://admissions.nmsu.edu/change-of-campus-request/) *form.*

**Transfer Students- Admission Requirements**

Transfer students must provide official transcripts sent directly from the *Registrar's Offic*e or each previously attended institution to the *NMSU Admissions Office* or official transcripts will be accepted if delivered in person only if in a sealed envelope from the granting institution and with current issue date. Official transcripts must be received before the date of registration.

Students who have not earned credit for the first semester of each college English may be required to provide ACT or SAT scores directly to the *NMSU Admissions Office*.

Students with 30 or more college credit hours must have a cumulative grade point average (GPA) of at least 2.0.

Students with 29 or fewer college credit hours must fulfill the freshman admission requirements and have an overall college GPA of at least a 2.50.

Students must be eligible to return to their last college or university.

Any student who conceals the fact that he/she has attended another college or university and has not submitted a transcript for each institution-whether or not credit was earned-will be subject to immediate suspension.

NMSU will uphold academic and judicial suspensions from other colleges and universities.

**General Requirements for Transfer Credits**

Credit will be awarded for transfer courses as follows:

* Grades earned in courses taken at other institutions are not included in the calculation of the NMSU GPA, except for grades earned by approved *National Student Exchange* students.
* A grade of D or better is required to receive NMSU credit for courses identified as having an NMSU equivalent.
* Colleges or departments may require a grade of C- or higher for courses required in their programs.
* Any lower-division course from another institution receiving transfer credit from NMSU at the 300 or above level will be evaluated on a case-by-case basis.
* Each college determines which transferred courses are applicable toward a degree or a minor.

Transcripts may need to be reevaluated when students transfer from one NMSU campus to another.

Currently enrolled students who do not receive a passing grade for a class taken within the NMSU system can receive transfer credit for the course taken at an outside institution. However, the student may not receive the credit for the equivalent NMSU (system) course.

**Student Responsibility**

Planning for effective transfer with maximum efficiency is ultimately the student's responsibility. Responsible transfer planning includes early and regular consultation with the intended degree-granting institution to assure that all pre-transfer coursework will meet the requirements of the desired degree.

NMSU maintains a database (http://nmsudirect.nmsu.edu) of commonly transferred courses from numerous institutions. Courses included in the database at the time the student is admitted to NMSU will automatically transfer to NMSU, provided the student follows all guidelines. If a transferred course does not exist in the database, it is the student's responsibility to provide the departmental faculty with sufficient materials (e.g. catalog description, syllabi, etc.) to determine if any of the department's courses may be equivalent to the credits being transferred.

**Evaluation of Transfer Credits**

NMSU has 3 levels of course credit transfer. Once a student has been admitted to NMSU, they are awarded credit for equivalent courses accordingly. Following award of credit as described in *Levels 1* and *2* (below), application of any additional credit transfer *via* specific *Program Articulation Agreements* will be approved by the student's academic department and dean, including additional courses in the major that may count toward a degree or a minor but are not included in a Program Articulation.

***Level 1***

Automatic course-to-course equivalency credit transfer from colleges/universities in the *State of New Mexico*, per the *New Mexico Higher Education Department (NM HED)* articulation modules. Eligible credits for Level 1 transfers will be automatically applied to the student's transcript, provided minimal grade requirements are met. Level 1 equivalency includes

* *New Mexico State Common Core* general education courses
* New Mexico State articulated academic programs (e.g. Business, Early Childhood Education, and NM Nursing Education Curriculum).

***Level 2***

Faculty established NMSU course-to-course equivalency transfer

Equivalency is determined by designated departmental faculty in the department/program in which the equivalent course is offered, and may include review of course description, syllabus and/or interaction with the other institution. If a course equivalency does not exist in the database, it is the student's responsibility to provide departmental faculty with sufficient materials to determine if any of the department's courses may be equivalent to the credits being transferred.

Credit for courses transcripted with NMSU equivalency will count toward the degree/major.

Credit for courses with no NMSU equivalence will be transcripted as 100E (lower level) or 300E (upper level) and may or may not count as credit toward a specific degree. Departmental faculty may accept the "E" course as elective credit toward the degree, or as substituting for a course not applied universally.

***Level 3***

Specific *Program Articulation* between an NMSU program/department and a program/department at another institution.

*Program Articulation* with other institutions is monitored at the department/program level in accordance with articulation agreements, and may include credit transfers that are applicable only to the specific degree articulated (i.e. credit for courses may change depending on degree student declares).

Because *Level 3* transfer credit is degree specific, transcripts must be re-evaluated when a student changes their major or college - *Level 3* transfer credits are not applied universally.

### C.2. College of Engineering

In addition to the above, the college enforces the following transfer credit policy:

* Policy for engineering majors enrolling in courses at other institutions to meet *College of Engineering Departmental Core Requirements*1.
* NMSU *Policy Manual* Chapter 6, section 89, paragraph A. “The decision to award a student credit for work completed at another institution rests with the faculty.”
* NMSU main campus engineering majors may take core classes at other institutions of higher education to meet NMSU *College of Engineering Departmental Core* if the NMSU core course cannot accommodate any more eligible students.
* The following conditions and restrictions apply to any course not taken on the NMSU main campus.
* The department must approve the course prior to enrollment (student to provide course syllabus and any other documentation to department head).
* The course must be a class in a program that is accredited by an accreditation commission of ABET, Inc. and cannot be graded S/U
* The course must be substantially the same as the equivalent NMSU class and the student must have satisfied all NMSU prerequisite requirements.
* The student shall provide a corresponding course syllabus and any other documentation required.
* If NMSU prerequisite requirements are not satisfied, credit will be denied regardless of a passing grade for the course at the other institution.
* In addition to 3 above, the following conditions apply to any on-line course not taken from the NMSU main campus.
* Scheduled exams, if any, shall be proctored2.
* If NMSU prerequisite requirements are not satisfied, credit will be denied regardless of a passing grade for the course at the other institution.

|  |  |
| --- | --- |
| 1 | Core requirements are defined as required departmental, discipline-related, courses within the major. |
| 2 | The student may take a NMSU-proctored exams ([http://distance.nmsu.edu/faculty/requiring-a-proctored-exam/](https://distance.nmsu.edu/faculty/requiring-a-proctored-exam/)) |

### C.3. Engineering Physics (EP) Program

There are no specific transfer requirements for the EP Program.

## D. Advising and Career Guidance

*Summarize the process for advising and providing career guidance to students. Include information on how often students are advised, who provides the advising (program faculty, departmental, college or university advisor).*

**D.1. University**

The University implemented *Central Advising* through the *Center or Academic Advising and Student Support (CAASS)* starting with the Fall 2017 advising period for Spring 2018 classes. *CAASS* has approximately 40 advisors working on behalf of a college team. All students are encouraged to meet with an academic advisor at least once a semester to stay on track toward completely their academic, career, and personal goals for attending NMSU. Advising holds are put in place to ensure that students have an opportunity to meet with an advisor to make the most educated decisions about upcoming semester course selection and long-term degree planning. All new freshmen and transfer students, undecided or exploratory students, pre-majors (e.g. pre-nursing, pre-social work), students with less than a 2.5, and students whose GPA is less than required for their designated major requirements will have academic advising holds.

### D.2. College of Engineering

The *College of Engineering* does not provide some formal advising and career guidance for declared engineering majors, in addition to those provided by the university or the department/program.

### D.3. Engineering Physics (EP) Program

Prior to each semester, *CAASS* places an advising hold to the *Banner* accounts of all NMSU students. In principle, *CAASS* oversees all advising activities and removing advising holds for students from freshmen to seniors. However, for majors enrolled in programs with complex curricula, *CAASS* advisors may lack the background and understanding of curricular issues and alternative approaches used to determine the best track toward graduation for individual students. The EP curriculum vastly differs for the four different concentrations, and it often requires individual course scheduling, course substitutions and similar. Therefore, the *Department of Physics* places an additional departmental advising hold on their continuing EP students, except for incoming freshman, a procedure that was agreed upon with *CAASS.* The departmental advising hold prevents the students from registering for classes until they have been advised by the department. Once the students have been advised, the advising hold is removed and the students will be able to register.

Advising begins with required *New Student Registration/Orientation (NSR)* for freshmen in the summer before the start of their first semester at NMSU. During the orientation, the students will do the following: be given an overview of the university and university life, take the *Math Placement Exam (MPE)*. Typically, they also meet with an EP Advisor to discuss the concentrations of the EP program and to place them in the correct classes in their starting semester.

Students often arrive with deficiencies in English and Math. Based on *SAT* and *ACT* English scores, students may be required to take remedial English courses, if necessary. All NMSU students are required to take at least two college level English courses. Similarly, Math placement is based on *SAT* or *ACT* scores and/or a *Math Placement Exam* administered by the *Department of Mathematics*. The EP curriculum presumes students begin in *Calculus I* (*MATH 191*) during their first semester. Students who are not prepared to start at calculus level will often take preparatory Math courses, Chemistry, and/or General Education courses during that transitional period. Those students generally take longer than other students to complete their degrees. Occasionally, the advisors try to meet the challenge of keeping these students interested and involved in the EP program by placing them into 100-level Physics courses.

Throughout their program, all students enrolled in EP have an assigned EP Advisor, who typically meets in person with every single of his/her advisees at the end of each semester for a progress review and advising of the upcoming semester. Advising duties for EP are currently shared between Drs. Hearn, Nakotte and Pate. The *Chair of the EP Program Committee* will send e-mail reminders to students who forget to arrange for a meeting with their advisor. Advising holds will be removed only after the student met with their assigned advisor. Advising for course enrollment in the upcoming semester entails the following steps:

**Advising Step 1 – Collect relevant registration materials**

* access to the student’s most current *STAR* audit transcript
* a list of relevant classes and their schedules (in catalog);
* a list of *Viewing a Wider World* courses (in catalog);
* a list of *New Mexico General Education Common Core* courses in the undergraduate catalog under which the student plans to graduate; and
* a plan of course schedules up to graduation (flow chart)

**Advising Step 2 – Draft a schedule**

* use the pre-requisite flowchart to check pre-requisites and co-requisites and identify long course sequences that can affect the number of semesters required to complete the degree program
* be aware that some core courses are not offered every semester
* choose humanities and social science electives from the list of approved courses, such that they satisfy both *NMSU” s General Education Requirements* and the *New Mexico General Education Common Core*.

Per semester, a typical student course load is 16 credits. The university has a maximum credit load of 18 that can only be exceeded by petition. Only under exceptional circumstances will the *Department of Physics* allow this.

**Advising Step 3 - Removal of Advising Hold and Class Registration**

Once the student has met with his/her advisor, the EP Advisor will inform the *Department of Physics* Head that the advising hold can be removed. This can be done either by the Head of the Department directly or through *CAASS.* After that, the student is cleared for on-line course registration. Alternatively, students may register by taking your signed course request card to the *College of Engineering* in Goddard Hall, Room 106.

EP Advisors keep track on the progress for each individual EP student advisee, and they are encouraged to fill out an *Advising Form* on any advisee/advisor interaction. The *Advising Form* has space for advisor notes, course substitutions, and an area for action items that require immediate attention.

**Initial Mathematics and English Placement**

Initial placement in Math and English for all majors at NMSU are determined by a combination of High School *GPA* and *ACT/SAT* score, or by performance on the *Math Placement Exam (*[*MPE*](https://www.math.nmsu.edu/msc/MPE/overview.html)*)*, offered by the Department of Mathematics; see the placement grid provided in Diagram 1.2.

***ENGR 100***

*ENGR 100* is a required course for all engineering majors. The course was introduced in 2014 to increase retention of students in the *College of Engineering*. *ENGR 100* provides a general overview of different engineering disciplines and it provides a first exposure to engineering approaches and its tools. Another goal of *ENGR 100* is the formation of student cohorts.

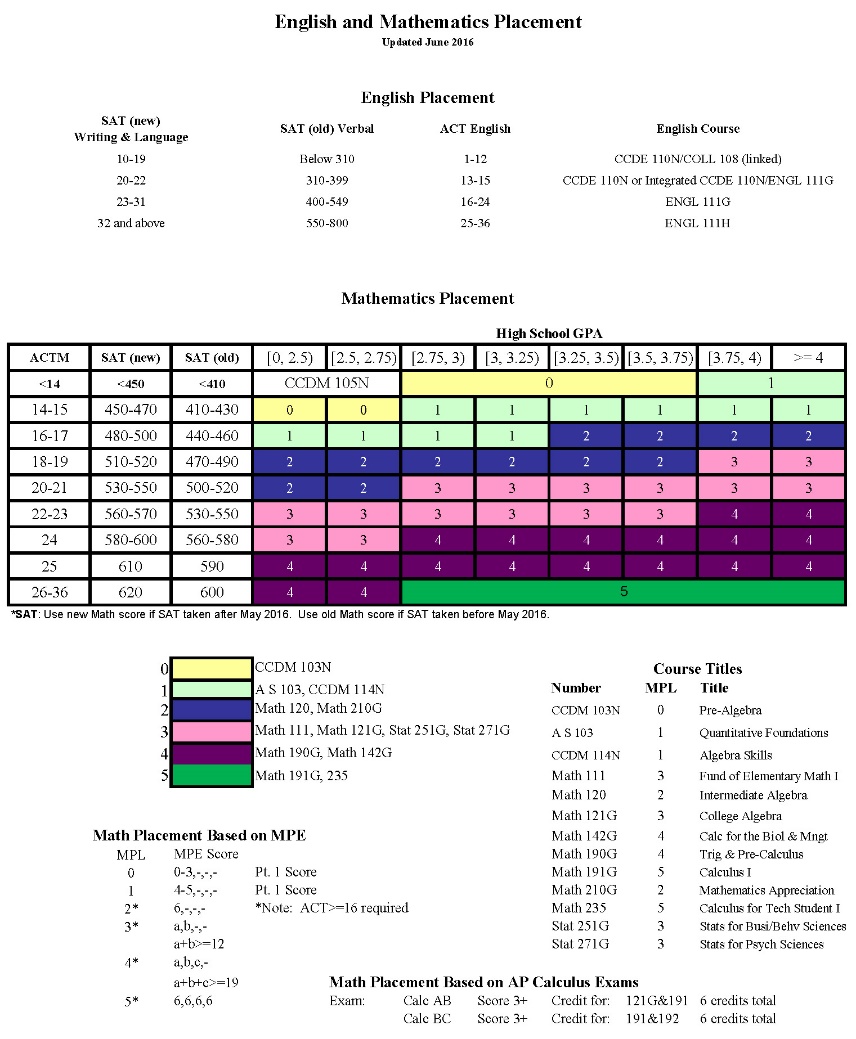
**Alternative Introductory Physics sequence**

EP students typically take *PHYS 213 & 213L* and *PHYS 214 & 214L* in their freshman year. These two courses and their labs are taught specifically to physics and EP majors. However, either part of that sequence may be replaced by the *PHYS 215 & 215L* and/or *PHYS 216 & 216L* service courses for general-engineering majors, since both course and lab sequences use the same calculus-based textbook.

***Viewing a Wider World***

NMSU requires two 3-credit Viewing-the-Wider-World courses. One of those courses can substitute as outlined in a section found in the catalog entitled *Alternatives for Meeting Viewing a Wider World Requirements*, which states: “*Students taking nine or more credits in a specific subject area, even though the courses are not designated as Viewing a Wider World courses, will have met the VWW requirements for that subject area.  The 9 credit hours must be in 300- to 400-level courses in one prefix area.”*  The catalog further states, “*One of the courses (3 credits) can be replaced by study abroad experience, consisting of at least four weeks of a Study Abroad program or university coursework in a foreign country earning 3 credits.*”

**Diagram 1.2.** Math and English Placement of Incoming Freshman



**Prospective graduates**

EP students who plan to complete graduation requirements at the close of the next semester or summer session should make an appointment for a record check with either one of the EP Advisors, preferably when they are getting advised.

**Closed classes**

Students can petition with the instructor to be enrolled in a closed section of a course. The instructor or the Head of the Department offering that course or the Academic Dean of the College can electronically overwrite the closed section for individual students, if permission is granted.

**Technical Electives**

A technical elective for EP students is a physics course with significant engineering content or an engineering course, numbered over 300. A list of approved technical electives for EP is provided in *Criterion 5 – Curriculum*. In general, technical electives are supposed to advance the student’s competence level in their respective EP concentration, and the students should discuss their elective choice with their advisor. Courses numbered 300 or above outside from other science departments may be approved for use as a technical elective, if the engineering content of the class is deemed sufficient by the *EP Program Committee*.

**Career Guidance**

Career advising of EP students continues throughout their academic programs. With strong participation from the two student societies, *SPS* and *SEPh*, the *Department of Physics* organizes and is involved in many activities geared toward career guidance and preparation, such as:

undergraduate research opportunities at NMSU,

finding summer internships in academia, national labs and/or industry,

on-campus visits and colloquia from representatives of industry, national labs or professional societies,

Physics GRE preparation workshops, and

CV workshops

These and similar activities allow that students learn about career opportunities and how to ‘sell yourself’ to potential employers of EP graduates. Furthermore, NMSU regularly holds on-campus *Career Fairs* with participation of companies and other entities that tend to recruit EP graduates.

## E. Work in Lieu of Courses

*Summarize the requirements and process for awarding credit for work in lieu of courses. This could include such things as life experience, Advanced Placement, dual enrollment, test out, military experience, etc.*

***Dual Credit* for High School Students**

The *Dual Credit Program* is designed to give high school students an opportunity to enroll at NMSU prior to high school graduation. Students must be either a junior or senior in high school and enrolled in one-half or more of the minimum course requirements approved by the following:

* *Public Education Department* in a *New Mexico Public School District*;
* Locally chartered and state-chartered charter school;
* State-supported school;
* Be in physical attendance at a bureau of Indian education-funded high school at least three documented contact hours per day.

Under *Senate Bill 158* signed by the Governor and effective July 1, 2014, support for dual credit privileges at post-secondary institutions is now available for private and home school-eligible students. Under a *Statewide Dual Credit Master Agreement* between NMSU and the school district, students enrolled in approved dual credit courses are eligible to have the full cost of tuition and general fees waived.

* Dual credit students must complete:
* the Undergraduate Admission Application;
* provide official high school transcript and official *ACT* or *SAT* scores to the Undergraduate Admissions Office; and
* complete the *State of New Mexico Dual Credit Request Form*.
* Requirements to be admitted to the dual credit or early admission programs are:
* high school grade point average (*GPA*) of 3.0;
* an *ACT* composite of 23 or equivalent *SAT* score; and
* substantial progress toward completion of the following high school courses: 4 units of English, 4 units of Math (Algebra 1, Geometry, Algebra 2, and one additional math course), 2 units of Science (beyond General Science), 1 unit of foreign language or a unit of fine arts.

**Credit by *College Level Examination Program (CLEP)***

Prior to or during a student’s enrollment at NMSU, credits may be earned through the *College Level Examination Program (CLEP)* of the *College Entrance Examination Board*. *CLEP* is a national program of credit by examination that offers the opportunity to earn credits for college level achievement wherever or however the student learned. Earned *CLEP* credit will be treated as transfer credit without a grade, will count toward graduation, and may be used in fulfilling specific curriculum requirements. A current *NMSU CLEP Policy* as well as test schedule information is available through *Testing Services* DACC East Mesa, RM 210. *Testing Services* may be reached at: (575) 528-7294.

**Credit by Examination**

Any enrolled student with a cumulative *GPA* of at least 2.0 currently attending classes may, with permission of the appropriate department, challenge by examination any undergraduate course in which credit has not been previously earned except an independent study, research or reading course, or any foreign language course that precedes the final course in the lower-division sequence. The manner of administering the examination and granting permission shall be determined by the department in which the course is being challenged. Students may not enroll in a single course, challenge it by examination, and drop it during the drop/add period, unless they enroll in an additional course. In exceptional cases in which a student demonstrates outstanding ability in a course in which he is already registered, he may be permitted to challenge the course. A student desiring to apply for special examination may obtain the necessary forms from the *Office of the Registrar*. The fee for challenging a course is the same as the approved tuition rate. Courses may not be challenged under the S/U option. The special examination privilege is based on the principle that the student, exclusively, has the responsibility for preparing for a special examination.

**Credit for Military Service**

NMSU will award academic credit to United States military personnel for courses and *Military Occupational Specialties (MOS)*, based on the *American Council of Education Guide (ACE)* as well as through national standardized tests, such as *CLEP*, *AP*, *PEP* and *DANTES*. Credit for military-training is in accordance with *NMSU Faculty Senate Legislation Proposition 24-07/08*, which was passed in May 2008. Military Training and *Military Occupational Specialties (MOS)* must have a recommendation evaluation by *ACE* (in the *ACE* Guide) for credit to be awarded. Courses accepted for transfer credit become part of the student’s official NMSU transcript and academic record. If a student wishes to appeal a decision regarding the acceptance of military training/education and/or MOS for academic credit, the student must submit a written statement of appeal to the Dean of the College to which the student has applied. The Dean will review the merits of the appeal and render a decision. The decision of the Dean is final.

Only *Primary MOS (s)* are eligible for academic credit in the initial review and evaluation. *Credit for Duty and/or Secondary MOS* may be eligible for academic credit if the student petitions the college’s Associate Dean. Primary *MOS* is the primary specialty of a soldier and reflects the broadest and most in-depth scope of military experience. Veterans, active-duty personnel, National Guard and Reservists who are current students or students applying for admission to NMSU may be granted academic credit on a case-by-case basis upon evaluation of military transcripts - the *Joint Service Transcript* (jst.doded.mil) and the *Community College of the Air Force* transcripts. Course equivalencies and credit hours awarded for a particular NMSU degree are determined by colleges and/or academic departments. Credit hours may be awarded for specific courses toward degree requirement, or as elective credit. The number of credit hours awarded will be determined by the college and/or academic department.

*NOTE: Students submitting military transcripts for credit evaluation must keep in mind the Maximum Time Frame policy. See* [*Financial Aid*](https://catalogs.nmsu.edu/nmsu/general-information/financial-aid-scholarship-services/) *Section.*

## F. Graduation Requirements

*Summarize the graduation requirements for the program and the process for ensuring and documenting that each graduate completes all graduation requirements for the program. State the name of the degree awarded (Master of Science in Safety Sciences, Bachelor of Technology, Bachelor of Science in Computer Science, Bachelor of Science in Electrical Engineering, etc.)*

### F.1. University (From NMSU 2017-2018 Catalog):

**Applying for a Degree**

Any students that are in their final semester of classes are considered degree candidates and are required to submit an ‘*Application for Degree*’ as well as pay graduation fees for each degree being sought. The *Application for Degree* form is available online through the *MyNMSU* website. It must be completed and submitted by the designated deadline for that semester. The fees for the Las Cruces campus are all listed in the [*Tuition, Fees and other Expenses*](https://catalogs.nmsu.edu/nmsu/essential-information-students/tuition-fees-other-expenses/)section of the catalog, once a student submits the application the fee will be included in the total cost for the semester or session in which the candidate anticipates completing their degree requirements.

If degree requirements are not completed during the semester/ session the student originally applied for, the student must then reapply and pay the appropriate fees. A $25 late fee applies to applications received after the application deadline, and no applications will be accepted after the posted deadline date.

A student must specify which catalog they are using for their degree requirements for the university to determine if the requirements are met and if a degree can be certified. The latest date for substitution or waiver of required courses for degree candidates is two weeks after the last date of registration for regular or summer terms.

### F.2. College (From NMSU 2017-2018 Catalog):

In addition to the University requirements and procedures above, at the beginning of the semester before graduation, the Assoc. Dean of Academics office creates a spreadsheet for all degree applicants listing outstanding deficiencies. The office works with each department to process necessary exceptions. Departments then notify students missing any requirements so they may register in time for classes. Students have a final chance to make up requirements in that semester they wish to graduate by taking mini-semester or 6-week courses.

## G. Transcripts of Recent Graduates

*The program will provide transcripts from some of the most recent graduates to the visiting team along with any needed explanation of how the transcripts are to be interpreted.* ***These transcripts will be requested separately by the Team Chair.*** *State how the program and any program options are designated on the transcript. (See 2017-2018 APPM, Section I.E.3.a.)*

Will be provided at time requested.

# CRITERION 2. PROGRAM EDUCATIONAL OBJECTIVES

This chapter describes the *Mission* and the *Program Educational Objectives* of the *Engineering Physics (EP)* program, the process for evaluating their relationship to constituency and/or program needs, and their connection to the *Institutional Mission* and their *Educational Objectives*.

The current *Program Educational Objectives* for EP were formulated in 2012, just prior to the previous ABET site visit. They were compiled with the help of the Engineering Physics External Advisory Board, taking into account additional considerations from administrators, faculty and staff of the *Departments of Physics, Mechanical & Aerospace Engineering, the Electrical & Computer Engineering, Chemical & Materials Engineering,* the *Colleges of Arts & Sciences* and *Engineering*, and the *University*.

## A. Mission Statement

*Provide the institutional mission statement.*

The mission statement of *New Mexico State University (NMSU)* is as follows:

*New Mexico State University is the state’s land-grant university, serving the educational needs of New Mexico’s diverse population through comprehensive programs of education, research, extension education, and public service.*

The mission statement of *NMSU’s College of Engineering* is as follows:

*The College of Engineering will uphold the land grant mission of NMSU through nationally recognized programs in education, research, and professional & public service.*

The mission statement of *NMSU’s Engineering Physics Program* is as follows:

*The mission of Engineering Physics at New Mexico State University is to offer an accredited degree that combines high-quality engineering and physics programs to best prepare our graduating students for careers in state-of-the-art industry or to move on to advanced study in engineering or physics.*

## B. Program Educational Objectives

*List the program educational objectives and state where these can be found by the general public*.

The *Department of Physics* at NMSU currently offers three undergraduate degrees, i.e. *Bachelors of Science in Physics (BS-Physics), Bachelors of Arts in Physics (BA-Physics)* *and Bachelors of Science in Engineering Physics (BS-EP)* and two graduate degrees, i.e. *Masters of Science (MS)* and *Doctoral Degree (PhD) in Physics*. In this *Self-Study Report* only the *Program Educational Objectives* of BS-EP are evaluated, although there is often considerable overlap with the educational objectives/goals of the other degrees offered.

The *Program Educational Objectives* for EP were revised in 2012, just prior to the 2012 ABET site visit, with considerable input from the EP program constituencies (defined in part D of this section) and from our 2012 *Engineering Physics External Advisory Board (EPEAB)*; see part E of this section. The current *Program Educational Objectives* of the EP program are listed in Table 2.1. They are formulated such that they best address the needs of our constituencies and to best achieve the goals stated in the various mission statements above.The *Educational Objectives* are formulated such that they capture the spirit of *ABET's Guidelines for Educational Obje*ctives.

**Table 2.1.** Program Educational Objectives of the Engineering Physics Program at NMSU.

**EP Educational Objective 1: Competitiveness.**

Graduates are competitive in internationally-recognized academic, government and industrial environments.

**EP Educational Objective 2: Adaptability.**

Graduates exhibit success in solving complex technical problems in a broad range of disciplines subject to quality engineering processes.

**EP Educational Objective 3: Teamwork and Leadership.**

Graduates have a proven ability to function as part of and/or lead interdisciplinary teams.

Our EP *Program Educational Objectives* are widely advertised and publicly available through departmental advertising/recruitment brochures, fliers & hand-outs, program weblinks, official documents & reports (such as this *Self-Study Report*). They also posted in various places throughout the department.

## C. Consistency of the Program Educational Objectives with the Mission of the Institution

*Describe how the program educational objectives are consistent with the mission of the institution.*

NMSU’s strategic planning activities originate at the highest level of the university in the President’s office. As a minority-serving land-grant institution, NMSU has established that its main overall mission is serving the people of New Mexico through education and research with special emphasis on preserving the state's multi-cultural heritage, protecting its environment, and fostering economic development in the state of New Mexico and the interdependent world. NMSU’s primary mission is to provide quality education to a student body of various ages, interests, and cultural backgrounds. The university seeks to educate each student not only in how to earn a living but also in how to live a meaningful life. Representatives of academic departments, colleges, support units and administrative units are involved in the development and assessment of a single strategic plan for the university and many related plans for the supporting units. An important task of strategic planning is to determine, advance, disseminate and refine the educational objectives of a program. These *Educational Objectives* must be consistent with the overall strategic mission of the University as well as those defined by the *New Mexico Commission of Higher Education (NMCHE)* and the *North Central Association (NCA)*. Over the past few years, NMSU has formulated and adopted an *Academic Strategic Plan*, called the [*Vision 2020 Strategic Plan*](https://plan.nmsu.edu/strategicplan/), with goals that are listed in Table 2.2.

Each of NMSU’s colleges, departments, academic programs and supporting units are required to produce their own individual strategic plans that should support the overarching strategic goals of the university. In this section, we hope to establish that the *Program Educational Objectives* of the EP program are consistent with and supportive of the institutional goals of NMSU.

**Table 2.2.** Current Vision 2020 Goals for NMSU

**Goal 1: Academics and Graduation.**

Provide stellar programs, instruction, and services to achieve timely graduation.

**Goal 2: Diversity and Internationalization.**

Provide a diverse academic environment supportive of a global society.

**Goal 3: Research and Creative Activity**.

Promote discovery, encourage innovation, and inspire creative activity.

**Goal 4: Economic Development and Community Engagement.**

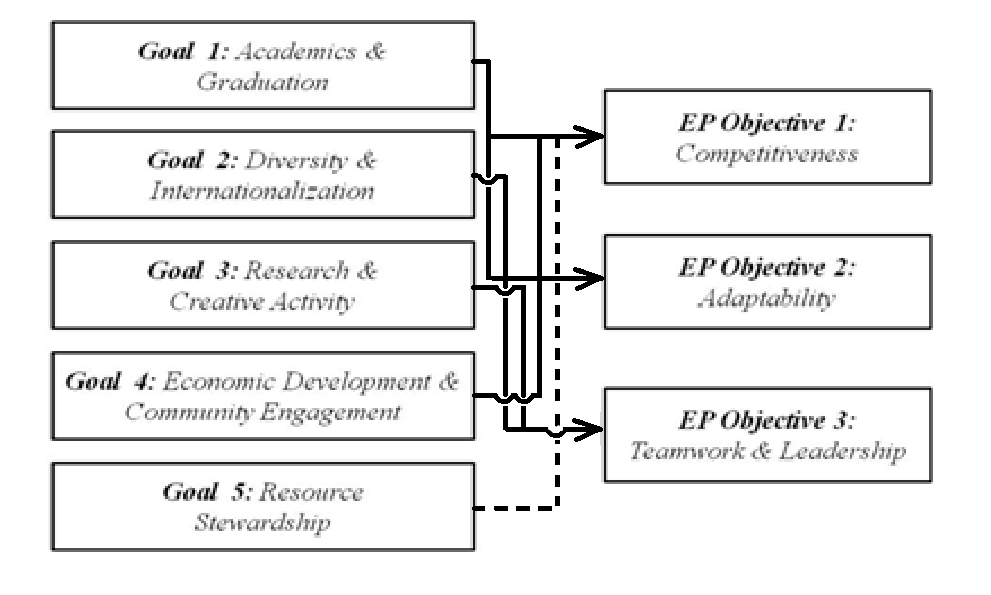
Drive economic, social, educational and community development.

**Goal 5: Resource Stewardship.**

Optimize resources to effectively support teaching, research and service.

Our three *Program Educational Objectives* for EP are closely linked to NMSU’s *Vision 2020* goals, as shown in diagram 2.1.

**Diagram 2.1.** Relationship of NMSU’s Vision 2020 Institutional Goals with the EP Educational Objectives.

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## D. Program Constituencies

*List the program constituencies. Describe how the program educational objectives meet the needs of these constituencies.*

The *Engineering Physics (EP)* degree is an engineering degree awarded through the *College of Engineering*, but it is housed in the *Department of Physics*, which belongs to the *College of Arts & Sciences*. The College of Engineering and the Department of Physics established an *Engineering Physics (EP) Program Committee* with members from the departments of *Physics*, *Aerospace & Mechanical Engineering*, *Electrical & Computer Engineering* and *Chemical & Materials Engineering*. EP students can select between four different concentrations: *Engineering Physics* with the Aerospace Concentration (EP-AE), *Chemical Concentration (EP-ChE)*, *Electrical Concentration (EP-EE)*, or *Mechanical Concentration (EP-ME)*.

The educational objectives of the EP program are strongly determined by the input, needs, demands, expectations and requirements of our constituencies. Below, we tabulate our constituencies and how they contribute to the development of our *Engineering Physics* program.

**EP students**

Students provide feedback to the program through mandatory student evaluations of each course taken, advising with the EP advisor each semester and senior-exit interviews with the department head.

**Potential Employers *(Industry, Academia, Government)***

This is probably the most important constituency group, and it is strongly represented on our *Engineering Physics External Advisory Board (EPEAB)*; for membership, see part B of this section. The *EPEAB* typically meets every other year, although more frequent annual meetings may be called, if needed. Members of the board provide important feedback to all aspects of the EP program, such as required skills of graduates, educational objectives and outcomes assessment. The *EPEAB* evaluates the overall program, identifies its strength and weaknesses and provides a written report that includes suggestions on how to improve the program. Apart from input through the advisory board, many of NMSU faculty and staff members have close interactions with representatives from industry and/or national laboratories, and their comments and suggestions are considered as well.

**Physics Faculty and Staff**

The *Department of Physics* holds annual retreats and all faculty and non-administrative support staff (instructors, lab coordinators) are required to attend. The central focus of the retreat is to discuss the progress and weaknesses of all physics programs, including needed changes in the curriculum and/or the overall program educational objectives.

To manage the cross-college EP program, the *Department of Physics* has created an *EP Program Committee* that includes members of the Department of Physics and the associated engineering departments. The *Physics Department Head* and the *Associate Dean of Engineering for Academics* are *ex-officio* members of this committee. Current membership of the *EP Program Committee* can be found in the first section of this Self-Study Document (*Background Information*). The *EP Program Committee* overseas the program progress, makes sure that assessment procedures are followed, continuously evaluates the health of the program, and implements necessary program changes. While the *EP Program Committee* directs the EP program, it relies on the involvement of other faculty members from physics and the participating engineering departments for program assessment and improvement.

**Faculty of Affiliated Engineering Programs**

Three engineering faculty members, one each from the *Departments of Mechanical & Aerospace Engineering, Chemical & Materials Engineering* and *Electrical & Computer Engineering*, serve on the *EP Program Committee*, and they participate in the committee meetings on a regular basis. The engineering committee members also serve as spokespersons for the needs and interests of the EP program at their respective home departments in the *College of Engineering*.

**Alumni**

Since its inception, the *Department of Physics* has tried to keep an updated list of its alumni, their addresses and their present occupation. In many cases, the department has succeeded to keep close contact with past alumni and it performs occasional alumni surveys. Moreover, the *EPEAB* has alumni representation on the board.

**Peer Institutions that offer EP or similar majors**

We are in close contact with other academic institutions that also offer an *Engineering Physics Programs*, accredited by *ABE*T. The *EPEAB* has a representative from such peer institutions, and we built on their experience for program progress and accreditation purposes.

**Graduate Schools**

Graduate schools are an important potential destination for our students. Several of our EP alumni pursue advanced graduate studies in physics or engineering following their graduation from EP. The curricula of the pre-existing physics and engineering programs are therefore tailored for the needs of students seeking graduate education. The *EPEAB* has current representation from academic institutions, which offers graduate programs to EP graduates.

**Citizens of New Mexico**

As the land-grant state university in New Mexico, NMSU and its programs have strong commitments to citizens of the state and in the region. Many of our EP students and their parents come from New Mexico, and the EP program is actively involved in many outreach and educational activities to the public.

Constituency needs are implemented into the *Program Educational Objectives* such that they are consistent with and supportive of the strategic mission of the university and its units. Each of the constituency groups plays an important, and often complementary, role in both the evaluation and the improvement of our EP program. Input from our constituencies is included in the assessment of the program and we aggressively solicit their assistance in further development of our program. Moreover, many of our constituencies serve as members of the *EPEAB*, see Tables 2.3-5. With their input, the EP program has been designed such that students acquire strong fundamental knowledge in physics and individual engineering concentrations, adopt effective communication and problem-solving skills, develop the ability to tackle new problems, and achieve a level of preparation that allows continuation to advanced studies after graduation. Graduates of the EP program should be able to apply their acquired skills to solve research and development problems of interest for industry, governmental laboratories or academic institutions. The potential employment opportunities for EP graduates are extensive, and they include research and development, energy and utility, manufacturing, automotive, photonics, aerospace, defense and space, sensor technology, and many other fields. While the EP program intends to prepare the students for a wide range of professional careers in industry and governmental laboratories, it will also prepare them for graduate studies in engineering or physics.

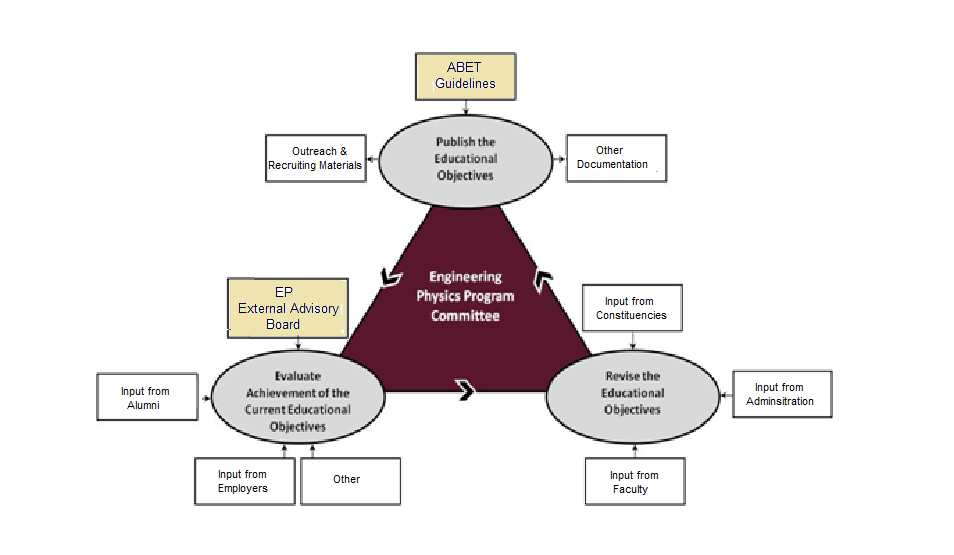
## E. Process for Review of the Program Educational Objectives

*Describe the process that periodically reviews the program educational objectives including how the program’s various constituencies are involved in this process. Describe how this process is systematically utilized to ensure that the program’s educational objectives remain consistent with the institutional mission, the program constituents’ needs and these Criteria.*

Evaluating and improving the *Program Educational Objectives* for our EP program is an ongoing and continuous process. If needed, adjustments and improvements to the educational objectives are initiated by *the EP Program Committee*, which will suggest changes and/or modifications to the objectives, if needed. Prior to implementing such changes, we will seek the advice and input from the *EPEAB* and other constituencies, such as faculty members or institutional entities.

The *EP Program Committee* collects continuous feedback about the achievement of its *Program Educational Objectives*. The EP program is still a small program in the *College of Engineering* at NMSU with only few graduates each year, and we can therefore collect feedback from alumni or employers through surveys or similar. The process for establishing, publishing and evaluating the *Program Educational Objectives* is shown in Diagram 2.2.

**Diagram 2.2.** Process flow-chart for establishing and evaluating the Program Educational Objectives of the Engineering Physics program.

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The main body in charge of evaluating whether the program is successful in achieving its *Educational Objectives* is the *EPEAB*. For each *EPEAB* site visit, the *EP Program Committee* will provide a collection of materials and updated data in support of whether the EP program achieves its *Educational Objectives*.

The *EPEAB* has four standing tasks:

* review current policies and procedures within the program,
* identify potential issues and areas of concern,
* evaluate whether the program achieves its stated *Educational Objectives*, and
* prepare a report for distribution to the *EP Program Committee* and the deans.

Since the *EPEAB* plays an instrumental role for the overall program evaluation and success or failure of achieving its *Educational Objectives*, their membership is of critical importance. The members for the 2012, 2014 and 2016 EPEAB are listed in Table 2.3.

**Table 2.3.** Members of the 2012, 2014 and 2016 EPEABs.

**2012 EPEAB**

*On-Campus Visit: January 23 & 24, 2012*

**Dr. Steven Castillo,** Sandia National Laboratory, Albuquerque, New Mexico**, Mr. Jon Haas (Chair),** NASA Johnson Space Center, Las Cruces, New Mexico**, Prof. Mark Holtz,** Texas Tech University, Lubbock, Texas**, Dr. Alan Lovell,** Air Force Research Laboratory, Albuquerque, New Mexico**, Prof. David Probst,** Southeast Missouri State University, Cape Girardeau, Missouri**, Dr. Mark Schraad,** Los Alamos National Laboratory; Los Alamos, New Mexico**, Dr. John Schaub *(EP Alumnus)*,** Valparaiso University, Indiana**, Mr. Ronald Tafoya,** Intel Corporation, Rio Rancho, New Mexico

**2014 EPEAB**

*On-Campus Visit: April 24 & 25, 2014*

**Dr. Steven Castillo,** Sandia National Laboratory, Albuquerque, New Mexico**, Ms. Laura Dominik,** Honeywell, Minneapolis, Minnesota**, Mr. Jon Haas (Chair),** NASA Johnson Space Center, Las Cruces, New Mexico**, Prof. Mark Holtz,** Texas Tech University, Lubbock, Texas**, Dr. Alan Lovell,** Air Force Research Laboratory, Albuquerque, New Mexico, **Prof. David Probst,** Southeast Missouri State University, Cape Girardeau, Missouri, **Dr. Mark Schraad (Chair),** Los Alamos National Laboratory; Los Alamos, New Mexico, **Mr. Ronald Tafoya**, Intel Corporation, Rio Rancho, New Mexico, **Mr. Luke Wyatt *(EP Alumnus)***, Sandia National Laboratory, Albuquerque, New Mexico

**2016 EPEAB**

*On-Campus Visit: May 6 & 7, 2016*

**Dr. Steven Castillo,** Sandia National Laboratory, Albuquerque, New Mexico**, Ms. Laura Dominik**

Honeywell, Minneapolis, Minnesota, **Mr. Jon Haas (Chair)**, NASA Johnson Space Center, Las Cruces, New Mexico, **Dr. Alan Lovell**, Air Force Research Laboratory, Albuquerque, New Mexico, **Mr. Nathaniel Nunley *(EP Alumnus)***, University of Texas, Austin, Texas, **Prof. David Probst**, Southeast Missouri State University, Cape Girardeau, Missouri, **Dr. Kurt Schoenberg**, Los Alamos National Laboratory; Los Alamos, New Mexico, **Mr. Ronald Tafoya**, Intel Corporation, Rio Rancho, New Mexico

In the past year, the *EP Program Committee* had to replace several past *EPEAB* members, due to retirement or resignation, and it also added two additional members (one from industry and on from academia). The current members of the *EPEAB* are listed in Table 2.4.

**Table 2.4.** Current Members Engineering Physics External Advisory Board.

**2017 EPEAB**

*On-Campus Visit: April 28 & 29, 2017*

**Dr. Steven Castillo**

Manager; Intelligence, Surveillance and Reconnaissance Systems Engineering & Decision

Sandia National Laboratory, Albuquerque, New Mexico

**Dr. Candi Cook**

Senior Process Engineer; Technology Development Group

Intel, Hillsboro, Oregon

**Ms. Laura Dominik**

Systems Engineer; Systems; Certified Project Management Professional (PMP) at Honeywell

Honeywell, Minneapolis, Minnesota

**Mr. Jon P. Haas**

Associate Principal Engineer; NASA Engineering & Safety Center

NASA Langley Research Center - White Sands Test Facility, Las Cruces, New Mexico

**Dr. T. Alan Lovell (Chair)**

Research Aerospace Engineer; Space Vehicles Directorate

Air Force Research Laboratory, Albuquerque, New Mexico

**Mr. T. Nathaniel Nunley *(EP Alumnus)***

PhD Student; Department of Physics

University of Texas, Austin, Texas

**Prof. David Probst**

Department Chair; Department of Physics & Engineering Physics

Southeast Missouri State University, Cape Girardeau, Missouri

**Dr. Kurt Schoenberg**

**Partner; Applied Science Enterprises; and former LANSCE User Facility Director**

**LANSCE, Los Alamos National Laboratory,** Los Alamos, New Mexico

**Dr. Katyayani Seal**

Technical Consultant; Quantum Design International

Quantum Design, San Diego, California

**Prof. Michael Stroscio**

Professor; Department of Electrical & Computer Engineering

University of Illinois, Chicago, Illinois

**Mr. Travis Willett-Gies *(EP Alumnus)***

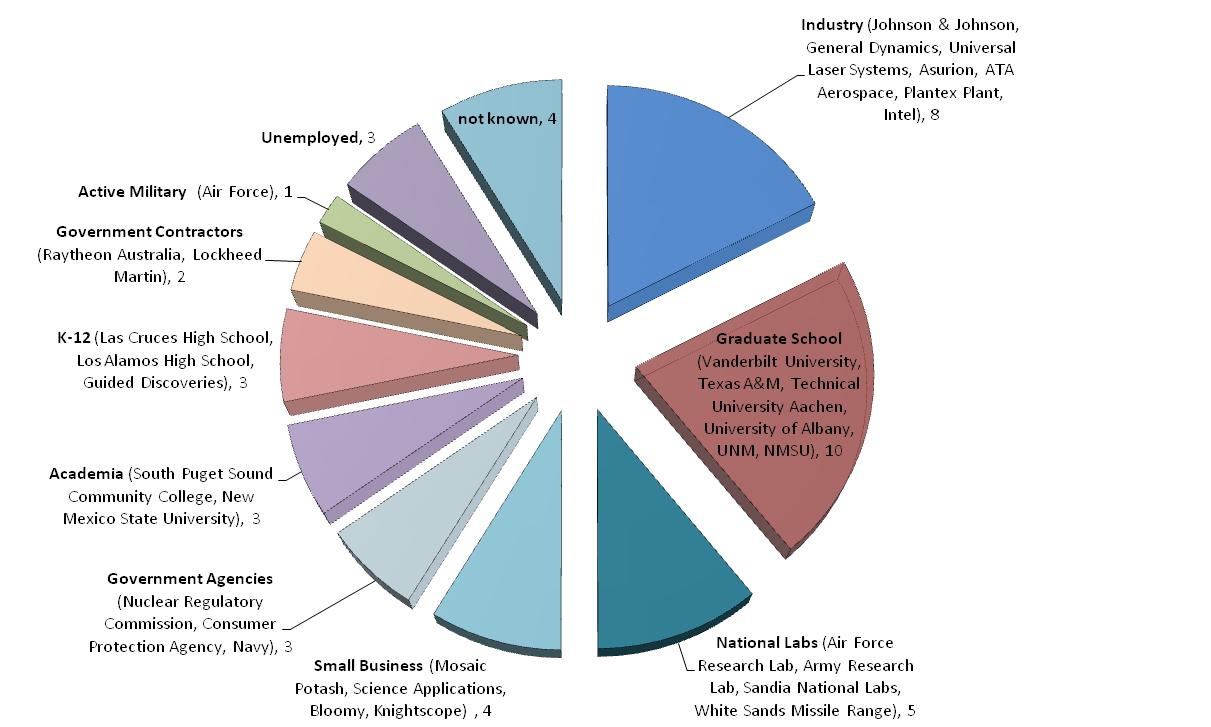
Systems Integration & Test Engineer; Space Services Division

ATA Aerospace, Albuquerque, New Mexico

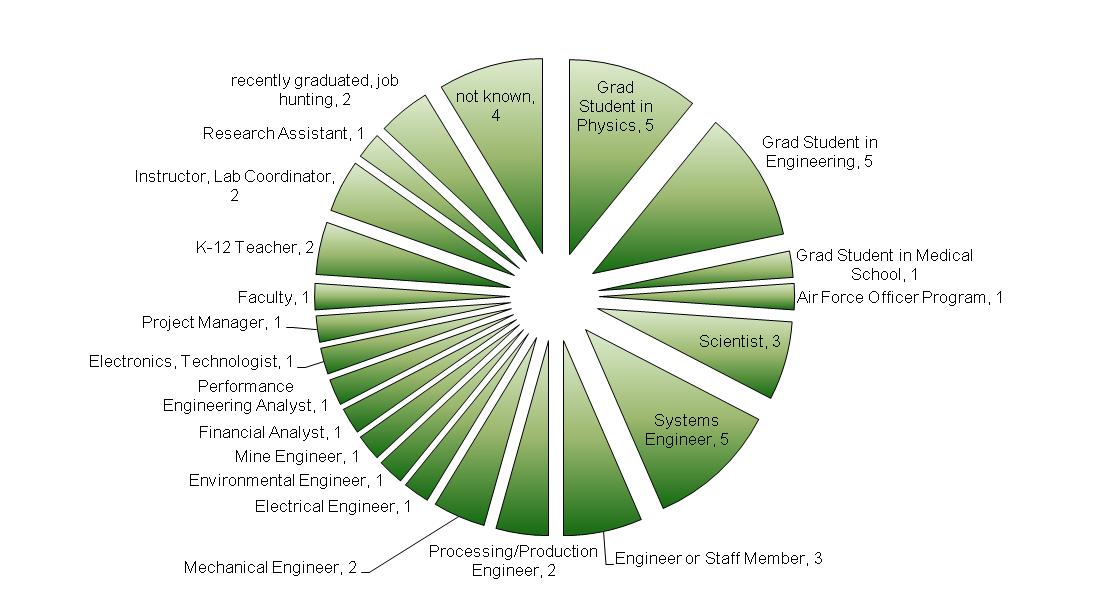
Aside from those permanent tasks, the *EPEAB* may be asked to provide their input to imminent changes to the curriculum, university administration, or similar. For example, the 2016 EPEAB reviewed the proposed changes to the *General Education* and *Viewing the Wider World* requirements as well as the possibility the EP degree could be administered in 120 credits without adversely affecting the program quality and accreditation.

To assist the board with the assessment of *Program Educational Objectives*, the *EP Program Committee* will provide any data that may be available about our alumni, such as employers and job placements. Diagrams 2.3 and 2.4 provide examples of data presented to the 2017 *EPEAB*.

**Diagram 2.3.** Career Choices of NMSU EP Alumni (data from Spring 2017).



**Diagram 2.4.** Job Titles of NMSU EP Alumni (data from Spring 2017).



In general, the *Department of Physics* hosts a 1-2 day on-campus meeting with the *EPEAB*. The meeting consists of formal presentations to all aspects of the program, including graduation rates, retention, curriculum, staffing and budgets, The *EPEAB* meets with all faculty members from physics and faculty representatives from the associated engineering programs. The board also meets separately with the EP students of all concentrations and sometimes alumni.

In the last six years, each EPEAB’s assessment of achievement of our *Program Educational Objectives* has been extremely positive, as evidenced by their written reports and the meeting minutes. For example, the 2017 *EPEAB* report stated:

*The data and metrics reviewed point to a very successful EP program. The NMSU EP Program Committee continues to demonstrate good stewardship of the Program through its efforts. Of particular importance is the Program’s proactive assessment of student feedback and attention to the details of changing curricula in connected departments, making course content adjustments as necessary. The EPEAB was presented with many good examples of student academic successes and students’ ability to find employment in scientific or technical organizations. Recent graduates are engaged in advanced degree programs at very respectable scientific or engineering schools, or employed in industry, academic, or research lab positions.*

*The EP Program has three educational Objectives:*

*EP Objective 1: Competitiveness. Graduates are competitive in internationally recognized academic, government, and industrial environments.*

*The EP Program continues to attract top students into its challenging curriculum, with approximately one-quarter each of EP Program graduates engaged in graduate-level academic programs, government-related careers, and industrial or business environments (others are teaching or unknown). Unemployment in science and engineering fields is generally low. EP Program graduation rates have been trending with enrollment, indicating good retention, with career choices for graduating EP students more diverse than for either physics or engineering graduates.*

*EP Objective 2: Adaptability. Graduates exhibit success in solving complex technical problems in a broad range of disciplines subject to quality engineering processes.*

*EP Program graduates are entering advanced courses of study, and being hired into a diverse selection of high-tech jobs in industry and government laboratories, with some engaged in entrepreneurship. The employment rates and diversity of opportunities not only demonstrate that the goals of the program are being met, but this also addresses the goals of NMSU. Engineering Physics graduates demonstrate ongoing contributions to New Mexico and the nation with greater economic impact. More than 10% of the employed (i.e., not continuing in a program of study) EP graduates report Systems Engineer as their current job title, indicating an interdisciplinary career; the remainder report 16 additional job titles, highlighting the diversity of professional opportunity open to EP graduates.*

*EP Objective 3: Teamwork and Leadership. Graduates have a proven ability to function as part of and/or lead interdisciplinary teams.*

*In this area, students with EP preparation excel. Preparation for leadership of interdisciplinary teams is a generally neglected element of university preparation for engineering and science careers. Simultaneously, the ability to lead interdisciplinary teams and perform complex system integration functions are among the most necessary skills for the success of large engineering and science development projects. EP Program graduates are well-prepared to address this gap. Recent Program statistics record that more than 20% of program graduates list supervisory duties and greater than 90% report working in team environments.*

Aside from feedback from the *EPEAB*, the *EP Program Committee* performed (voluntary) alumni surveys in 2014 and 2017, which included questions to the alumni whether the EP Program achieves its three *Educational Objectives*. The two surveys were sent to students who graduated between 3 and 10 years prior to the survey. The results of these two surveys are provided in Table 2.5. The results of those two surveys provide further evidence that the EP Program generally achieves its *Educational Objectives*.

All materials connected to the *Educational Objectives* of the EP program are compiled in the ‘Black’ Educational Objectives Notebook, the contents of which are listed below.

**‘Black’ *Eduational Objectives* Notebook** (filled in as needed)

* *Engineering Physics (EP) Program Committee* meeting minutes
* *Engineering Physics External Advisory Board (EPEAB) Reports* and meeting minutes
* summaries of *Alumni Surveys*
* other relevant information

**Table 2.5.** Results of Alumni-Survey Questions: Did NMSU EP achieve its Educational Objectives?

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Survey** | **Educational Objectives** | ***Number of Responses*** | ***Strongly Agree*** | ***Agree*** | ***No Opinion*** | ***Disagree*** | ***Strongly Disagree*** |
| 2014 | *Objective 1:* Competitiveness | *10* | 2 | 5 | 2 | 1 |  |
| *Objective 2:* Adaptability | *10* | 5 | 5 |  |  |  |
| *Objective 3:*  Teamwork & Leadership | *10* | 5 | 5 |  |  |  |
| *Overall Satisfaction with Learning Experience* | *10* | 3 | 7 |  |  |  |
| 2017 | *Objective 1:* Competitiveness | *11* | 2 | 8 | 1 |  |  |
| *Objective 2:* Adaptability | *11* | 5 | 6 |  |  |  |
| *Objective 3:*  Teamwork & Leadership | *11* | 3 | 6 | 1 | 1 |  |
| *Overall Satisfaction with Learning Experience* | *11* | 7 | 4 |  |  |  |

**CRITERION 3. STUDENT OUTCOMES**

**A. Student Outcomes**

*List the student outcomes for the program and indicate where the student outcomes are documented. If the student outcomes are stated differently than those listed in Criterion 3, provide a mapping of the program’s student outcomes to the student outcomes (a) through (k) listed in Criterion 3.*

**EP Program Outcomes**

The *Engineering Physics (EP)* program utilizes the resources of five different programs: *Physics*, *Aerospace Engineering,* *Chemical Engineering*, *Electrical Engineering* and *Mechanical Engineering*, which are hosted in four different departments. All above engineering programs, including EP, are currently *ABET* accredited and are preparing for re-accreditation. Each of the programs has a common set of *Program Outcomes (a)-(k),* as required by *ABET*.

While other engineering programs at NMSU typically have additional program-specific outcomes as well, this is not the case for the EP program. Each of the other engineering programs at the *College of Engineering* have their own established *Program Outcomes & Assessment Procedures* to assess *Program Outcomes (a)-(k)* through their courses. Obviously, the EP program has essentially no influence on the other engineering program’s current procedures, which the relevant engineering departments formulated such that they were deemed adequate for their own majors. Therefore, the EP program formulated their own *Program Outcomes & Assessment Procedure* using courses and other measures under full control of the *Department of Physics*.

It should be noted, however, that curricular changes (e.g. course sequence, delivery and content) in participating engineering departments may affect the EP program as well. This is another reason why representatives of participating engineering departments are members the *EP Program Committee*. If needed, these engineering representatives will disseminate and discuss the internal findings, assessment results and proposed course actions. In addition, these representatives help develop and change the *EP Program Outcomes & Assessment Procedure*, as appropriate. The separate assessment responsibilities of courses taught in *Physics* or *Engineering* courses provides the benefit of multiple independent and complementary measurements for each *Program Outcome*.

After consultation with faculty members from the *College of Engineering*, the *Department of Physics*, the *EP External Advisory Board (EPEAB)*, industry representatives, and current students and graduates, it was concluded that the current *Program Outcomes (a)-(k)* would continue suffice to ensure the quality of our EP program. An additional advantage is that these outcomes are common to the all the engineering programs, making the cross-departmental and cross-college EP assessment more straightforward. Subsequently, we continue to adopt the *ABET 2000 Program Outcomes (a)-(k)*, with some minor addition in the *Program Outcomes (e)*, *(h)* and *(k)*, where we included ‘physics’ specifically. The EP Program Student Outcomes are listed in Table 3.1., and each of the *Program Outcomes* was named with an identifying acronym for future reference.

***Table 3.1.*** *Engineering Physics (EP) Program Outcomes.*

**Scientific Expertise:** an ability to apply knowledge of mathematics, science, and engineering.

**Experimental Training:** an ability to design and conduct experiments, as well as to analyze and interpret data.

**Design Abilities:** an ability to design a system, component, or process to meet desired needs with realistic constraints such as economic, environmental, social, political, ethical, health & safety, manufacturability, and sustainability.

**Teamwork:** an ability to function on multi-disciplinary teams.

**Problem Solving:** an ability to identify, formulate, and solve engineering and physics problems.

**Professional Responsibility:** an understanding of professional and ethical responsibility.

**Communication Skills:** an ability to communicate effectively.

**Societal Impact:** the broad education necessary to understand the impact of engineering and physics solutions in a global, economic, environmental, and societal context.

**Life-long Learning:** a recognition of the need for and an ability to engage in life-long learning.

**Contemporary Issues:** a knowledge of contemporary issues.

**Technical Know-How:** an ability to use the techniques, skills, and modern engineering tools necessary for engineering physics practice.

Like the other engineering programs, *EP Program Outcomes* assessment is mostly done *via* measurements in individual courses. The *EP Program Committee* has assigned outcomes measures to every course. Prior to the course, each instructor is informed about which of the *Program Outcomes* he/she is supposed to measure. While the *EP Program Committee* provides guidance to assigned instructors on how certain *Program Outcomes* may be measured, it is left up to the instructor to develop adequate quantitative assessment tools themselves. In most cases, instructors will utilize previously established assessment tools. The *Course Assessment Matrix for Physics Courses* has undergone changes in the past years by adding a few more courses that measure outcomes h, i and j. This occurred when some of the EP Concentrations removed certain elective courses. This left a gap in measurement for these outcomes and the gap was filled by adding measurement of outcomes h, i and j to a few of the core Physics courses.The current *Course Assessment Matrix for Physics Courses* is provided in Table 3.2.a

The last row in the table indicates how often each *Program Outcome* is expected to be measured for any EP throughout completion of the program. Note, that some of the rows contain two courses, both of which will measure the same program outcomes. In some cases, the two courses may be alternative options (e.g. *PHYS 213* or *PHYS 215G*). In other cases, however, the two courses may both be required and will be taken in sequence (e.g. *PHYS 454* and *455*, or *PHYS 461* and *462*), thus providing two independent measures of particular *Program Outcomes*. The curriculum of our EP program and the content of the courses have been designed such that there are multiple independent measures for achievement of our *Program Outcomes (a)-(k)*.

***Table 3.2.a.*** *Physics Course Assessment Matrix for Program Outcomes (a)-(k)*

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Required Courses** | | | | | | | | | | | |
| Physics 213 or 215G Mechanics | X |  |  |  |  |  |  |  |  |  |  |
| Physics 213L or 215GL Mechanics Lab |  | X |  |  |  |  |  |  |  |  |  |
| Physics 214 or 216G Electricity & Magnetism | X |  |  |  |  |  |  |  |  |  |  |
| Physics 214L or 216L Electricity and Magnetism Lab |  | X |  |  |  |  |  |  |  |  |  |
| Physics 217  Heat, Light, & Sound | X |  |  |  |  |  |  |  |  |  |  |
| Physics 217L  Heat, Light, & Sound Lab |  | X | X | X |  |  |  |  |  |  |  |
| Physics 315  Modern Physics | X |  |  |  |  | X |  | X | X | X |  |
| Physics 315L  Modern Physics Lab |  | X | X | X |  |  | X |  |  |  | X |
| Physics 395  Math Methods |  |  |  |  |  |  |  |  |  |  | X |
| Physics 454  Intermediate Modern Physics I |  |  |  |  | X |  |  |  |  |  |  |
| Physics 455  Intermediate Modern Physics II |  |  |  |  | X |  |  |  |  |  |  |
| Capstone |  |  |  |  |  |  | X |  |  |  | X |
| *Number of times an outcome*  *is measured in required courses* | *4* | *4* | *2* | *2* | *2* | *1* | *2* | *1* | *1* | *1* | *3* |
| Required Courses for some EP Concentrations | | | | | | | | | | | |
| Physics 461  Int. Electricity & Magnetism I |  |  |  |  | X | X |  | X | X | X |  |
| Physics 462  Int. Electricity & Magnetism II |  |  |  |  | X | X |  | X | X | X |  |
| Physics 480  Thermodynamics |  |  |  |  | X | a |  | a | a | a |  |
| Physics 451  Intermediate Mechanics |  |  |  |  | X | X |  | X | X | X |  |
| *Number of times an outcome for any EP student* |  |  |  |  | *2-3* | *1-3* |  | *1-3* | *1-3* | *1-3* |  |
| Physics Course Electives | | | | | | | | | | | |
| Advanced Physics Lab |  | X | X | X |  |  | X |  |  |  | X |
| Physics 476  Computational Physics |  |  | X |  |  |  |  |  |  |  | X |
| Physics 495  Math. Methods of Physics |  |  |  |  |  |  |  |  |  |  | X |
| Physics 488  Solid State Physics |  |  |  |  |  | X |  | X | X | X |  |
| Physics 489  Modern Materials |  |  |  |  |  | X |  | X | X | X |  |
| Other Physics Electives |  |  | a | a |  | a |  | a | a | a | a |
| *Number of times an outcome for any EP student* |  | *0-1* | *0-1* | *0-1* |  | *0-1* | *0-1* | *0-1* | *0-1* | *0-1* | *0-1* |
| Non-Course Assessment Tools | | | | | | | | | | | |
| Senior-Exit Interviews | X | X | X | X | X | X | X | X | X | X | X |
| MFT Test | X |  |  |  | X |  |  | X |  |  |  |
| *Number of times an outcome for any EP student* | ***2*** | *1* | *1* | *1* | ***2*** | *1* | *1* | *2* | *1* | *1* | *1* |

*a: whether this Program Outcome is measured depends on the individual instructor and/or the topic of the course.*

Several faculty members in the *Department of Physics* have occasionally complained about an obvious flaw of the current assessment matrix, namely that some courses are required to measure multiple *Program Outcomes*, while other course are required to measure just one. Subsequently, instructors of those courses carry a higher burden in the assessment effort. Although the *EP Program Committee* did entertain some discussion on how course assessment could be distributed more uniformly, it was decided to postpone a re-distribution for now, given that *ABET* is expected to change its *Program Outcomes* definitions in the very near future.

Similarly, the participating engineering departments have published their own *Course Program Assessment Matrices*, see Tables 3.2.b-e.

***Table 3.2.b.*** *Aerospace-Engineering Course Assessment Matrix for Program Outcomes (a)-(k)*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Mapping of Aerospace Engineering Curriculum to Program Outcomes** | | | | | | | | | | | | | | | |
|  | | **Contribution to Program Outcomes** | | | | | | | | | | | **AE specific Program Criteria** | | |
| ability to apply knowledge of mathematics, science, and engineering | ability to design and conduct experiments, as well as to analyze and interpret data | ability to design a system, component or process to meet desired needs within realistic constraints | ability to function on multidisciplinary teams | ability to identify, formulate, and solve engineering problems | understanding of professional and ethical responsibility | ability to communicate effectively | the broad education needed to understand the impact of engineering in a variety of contexts | recognition of the need for, and an ability to engage in lifelong learning | knowledge of contemporary issues | ability to use the techniques, skills and modern tools necessary for engineering practice | knowledge covering aeronautical or astronautical engineering areas | knowledge of some topics from area not emphasized | design competence |
| **Curriculum Area** | **Credits** | **a** | **b** | **c** | **d** | **e** | **f** | **g** | **h** | **i** | **j** | **k** | **AE1** | **AE2** | **AE3** |
| ME 261 | 3 | **X** |  |  |  | **X** |  |  | Fulfilled by NMSU General Education Requirements |  |  | **X** |  |  |  |
| AE 339 | 3 | **X** | **X** | **X** |  | **X** |  |  |  |  |  | **X** | **X** |  |
| AE 362 | 3 | **X** |  |  |  | **X** |  |  |  |  | **X** | **X** | **X** |  |
| AE 363 | 3 | **X** |  |  |  | **X** |  |  |  |  | **X** | **X** | **X** |  |
| AE 364 | 3 | **X** |  |  |  | **X** |  |  |  |  | **X** | **X** | **X** |  |
| AE 419 | 3 | **X** |  |  |  | **X** |  |  |  |  | **X** | **X** | **X** |  |
| AE 424 | 3 |  |  | **X** | **X** |  |  | **X** |  |  |  | **X** | **X** | **X** |
| AE 428 | 3 |  |  | **X** | **X** |  |  | **X** |  |  |  | **X** |  | **X** |
| AE 439 | 3 | **X** |  |  |  | **X** |  |  |  |  | **X** | **X** |  |  |
| AE 447 | 3 | **X** | **X** |  |  | **X** |  | **X** |  |  |  | **X** | **X** |  |
| ME 449 | 1 |  |  |  |  |  | **X** | **X** | **X** | **X** |  |  |  |  |
|  | | | | | | | | | | | | | | | |
| **X** = courses assessed for outcome | | | | | | | | | | | | | | | |

***Table 3.2.c-d.*** *to be provided by engineering programs.*

***Table 3.2.e.*** *Mechanical-Engineering Course Assessment Matrix for Program Outcomes (a)-(k)*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Mapping of Mechanical Engineering Curriculum to Program Outcomes** | | | | | | | | | | | | | | | | |
|  | | **Contribution to Program Outcomes** | | | | | | | | | | | **ME Specific**  **Program Criteria** | | | |
| ability to apply knowledge of mathematics, science, and engineering | ability to design and conduct experiments, as well as to analyze and interpret data | ability to design a system, component or process to meet desired needs within realistic constraints | ability to function on multidisciplinary teams | ability to identify, formulate, and solve engineering problems | understanding of professional and ethical responsibility | ability to communicate effectively | the broad education needed to understand the impact of engineering in a variety of contexts | recognition of the need for, and an ability to engage in lifelong learning | knowledge of contemporary issues | ability to use the techniques, skills and modern tools necessary for engineering practice | knowledge of chemistry and calculus-based physics with depth in at least one | ability to apply advanced mathematics, multivariate calculus, and differential equations | familiarity with statistics and linear algebra | ability to work professionally in both thermal and mechanical systems areas | |
| **Curriculum Area** | **Credits** | **a** | **b** | **c** | **d** | **e** | **f** | **g** | **h** | **i** | **j** | **k** | **ME1** | **ME2** | **ME3** | **ME4** | |
| **Required Mechanical Engineering Courses** | | | | | | | | | | | | | | | | |
| ME 159 | 2 |  |  | **X** |  |  | **X** |  | Fulfilled by NMSU General Education Requirements |  |  | **X** | Fulfilled by Natural Sciences Requirements (PHYS 215, PHYS 216, CHEM 111, CHEM 112) |  |  | **X** | |
| ME 222 | 3 |  |  |  |  |  |  |  |  |  | **X** |  |  | **X** | |
| ME 228 |  | **X** | **X** | **X** |  | **X** |  |  |  |  |  | **X** |  | **X** | |
| ME 236 | 3 | **X** |  |  |  | **X** |  |  |  |  | **X** | **X** |  |  | |
| ME 234 | 3 |  |  |  |  | **X** |  |  |  |  |  | **X** |  |  | |
| ME 240 | 3 |  |  |  |  | **X** |  |  |  |  |  | **X** |  | **X** | |
| ME 261 | 4 | **X** |  |  |  | **X** |  |  |  |  | **X** | **X** | **X** |  | |
| ME 326 | 3 |  |  | **X** | **X** |  | **X** |  |  | **X** |  | **X** |  | **X** | |
| ME 328 | 3 | **X** |  |  |  |  |  |  |  |  |  | **X** | **X** |  | |
| ME 338 | 3 | **X** | **X** | **X** |  | **X** |  |  |  |  |  | **X** |  | **X** | |
| ME 340 | 3 |  |  |  |  | **X** |  |  |  |  |  | **X** |  |  | |
| ME 341 | 3 | **X** |  |  |  | **X** |  |  |  |  |  | **X** |  | **X** | |
| ME 345 | 3 |  | **X** |  |  |  |  | **X** |  |  | **X** |  | **X** |  | |
| ME 425 | 3 | **X** |  | **X** |  | **X** |  |  |  |  | **X** |  |  | **X** | |
| ME 426/427 | 6 |  |  | **X** | **X** |  |  | **X** |  |  |  |  |  | **X** | |
| ME 445 | 3 |  | **X** |  |  | **X** |  | **X** |  |  |  | **X** | **X** | **X** | |
| ME 449 | 1 |  |  |  |  |  | **X** | **X** | **X** | **X** |  |  |  |  | |
|  | | | | | | | | | | | | | | | | |
| X =course assessed for outcome | | | | | | | | | | | | | | | | |

Each faculty member is responsible for measuring the assigned *Program Outcomes*. These are documented in the instructors *Post Instructor Comment Form*, a copy of which is provided in the appendix. The completed *Post Course Instructor Comment Form* and other relevant materials for each course are electronically stored in an assigned folder. The *Department of Physics* performs annual reviews of achievement for each *Program Outcomes* and uses the data to determine whether program or course changes are needed. Program Outcomes Assessment and Reviews are collected and compiled electronically and in print in a separate folder.

Like Physics, the participating engineering programs have developed their own assessment matrices for their engineering courses, as shown in Table 3.2.b-e. For the engineering courses, assessment of the *Program Outcomes (a)-(k)* is done in the engineering department, which hosts that program for their majors, i.e. the *Department of Electrical & Computer Engineering* will assess *EE* courses, the *Department of Mechanical & Aerospace Engineering* will assess *AE* and *ME* courses, and the *Department of Chemical & Materials Engineering will* assess *ChME* courses. Since EP students do not have the same course requirements in their concentration compared to the majors in that engineering degree, the engineering assessment will not necessarily cover every single of those program outcomes independently (although it typically covers most of them) for every single EP student.

**Course Program Outcomes Assessment**

The *Department of Physics* has had a long history of monitoring student progress and learning (well before the introduction of the EP program) since *Physics Education* had been one of its research strength in the department going back to the early 1990s. While the then-developed assessment tools could be easily extended to measure some of the *ABET Program Outcomes*, particularly *Program Outcomes (a), (b)* and *(e)*, the instructors developed their own assessment tools for many of the other *Program Outcomes*, typically under the guidance of the *EP Program Committee*. In general, the *EP Program Outcomes & Assessment Procedure* is driven by the desire that each of the *Program Outcomes* should be measured by multiple courses and methods. Doing so, we made sure that the process is less dependent on individual courses, types of measurements, assessment methods or individual instructors. Below, we summarize some of the assessment approaches for the different *Program Outcomes*.

**Nationally-normed tests**

The *Department of Physics* commonly uses standardized national tests for measurements of achievement particularly for *Program Outcome (a) - Scientific Expertise* and *Program Outcome (e) - Problem Solving*.

For more than 20 years, the *Department of Physics* made use of *Graduate Record Exam (GRE)* questions to monitor student competitiveness at a national level. *GRE* questions are embedded in homework and/or exam problems, and the results can be taken as a direct measure of *Program Outcome (e) – Problem Solving*.

Similarly, we use the *Force Concept Inventory (FCI)* test, which can be taken as a direct measure of *Program Outcome (a) - Scientific Expertise*. The FCI test was first introduced by Hestenes, Wells and Swackhamer, *The Physics Teacher* 30, 1992, 141-158. The *FCI* measures the understanding of the basic concepts of Newtonian physics. For some courses, this test is given both at the beginning and end of the course to gauge the net student gain. Typically, the *FCI* test is used in freshman courses, but we have also given it as part of the upper-division physics mechanics course. Freshman students are typically below the *entry level* but should be past that at the end of their first year; graduating students should be at the *mastery level*.

In some cases, instructors used the national average of skill-builder questions in on-line homework programs, such as *Mastering Physics®* used in introductory courses, as additional measurement for *Program Outcome (a) - Scientific Expertise*.

**Tests and probes previously developed by NMSU *Physics Education Research (PER)* group**

The Department of Physics was very fortunate to have Dr. Steve Kanim as one of its faculty members. While Dr. Kanim is now retired, he still has ongoing research is in *Physics Education Research (PER)*. He helped developed many different (nationally recognized) exams and other probes to test student’s conceptual understanding of physics.

As part of his research, he had also developed much of the material for the introductory physics laboratories, particularly for *PHYS 213L* and *PHYS215GL*, the introductory mechanics labs in physics. These labs allow that student performance can be evaluated at several levels, one of which provides a measurement for *Program Outcome (b) – Experimental Training*. Dr. Kanim also co-authored the *E&M TIPERs; Electricity & Magnetism Tasks* (ISBN-10: 0131854992), which is widely used nationally for the instruction of introductory electricity and magnetism, including our *PHYS 214L* and *PHYS216GL* labs.

Dr. Kanim also designed several standardized pre-requisite tests, which are given to students prior to the course. The purpose of the pre-requisite tests is to test whether students have been adequately prepared and remember the pre-req materials needed for taking a course. While most pre-requisite test are not *a priori* designed to measure ABET *Program Outcomes*, they test the level of student learning, therefore providing input on how to improve content delivery. One of his more commonly administered tests is the so-called *Mechanics & Electricity Assessment Test (MEAT)*, which does provide *Program Outcomes* measure.

**Assessment tools developed by *Engineering Physics (EP) Program Committee***

The *EP Program Committee* designed a *Teamwork Evaluation Form* and an *Oral Report Evaluation Form* that can be used by individual instructors to assess *Program Outcome (d) – Teamwork* and *Program Outcome (g) Communication Skills*, respectively. Instructors are free to choose whether to make use of the provided forms for the evaluation of these two outcomes, and most of them do. These forms are provided in *Supplementary Information*.

**Assessment tools developed by individual instructors**

*Program Outcomes (c) - Design Abilities*, *(f) – Professional Responsibility*, *(h) – Societal Impact*, *(i) – Life-long Learning*, *(j) – Contemporary Issues* and *(k) – Technical Know-how*, are typically assessed using assessment tools designed by individual instructors.

*Program Outcome* *(c)* and *(k)* are mostly technical in nature, and they are typically extracted from scores or partial scores of individual assignments or projects, such as a capstone design task.

*Program Outcomes* *(f)*, *(h)*, *(i)* and *(j)* have been found to be the most difficult to determine. Instructors have used a variety of approaches to come up with quantitative measures for the *Program Outcome(s)*, such as sub-scores in essays, class attendance, specialized assignments, class participation or similar.

**Other Program Outcomes Assessment**

The *Department of Physics* uses a senior-level test from the *Educational Testing Service® (ETS) - the Physics Major Field Test*. This test is given annually at the end of an upper-level physics course, such as *PHYS 455 (Quantum Mechanics II*) or *PHYS 462 (Intermediate Electricity and Magnetism II)*, but it is open to all seniors in physics or EP. Students are encouraged to take the test in their senior year, and participation is fully paid for by the *Department of Physics.* While the *ETS* test is not mandatory, students participating in itcan earn extra-credit points in above upper-division courses and thus every EP student will take the test at least once. The *ETS* test is a commercially-produced test that is widely used physics and engineering programs across the country. It provides a comparison with the national norm for general physics topics in mechanics, electricity & magnetism, thermodynamics, and modern physics. The *ETS* test allows the course instructor to use individual scores for the second part of the exam as part of the course grade, while using group scores for individual subjects to evaluate both *Program Outcome (a) - Scientific Expertise* and *Program Outcome (e)* *- Problem solving*.

EP students in their graduating semester are asked complete a *Senior Student Exit Interview (SSEI)*, which include questions about students’ perceptions for achievement of each of the *Program Outcomes (a)-(k).*

More details of the *Program Assessment Tools* for each individual *Program Outcome* are presented in *Criterion 4 – Continuous Improvement*.

**Documentation for Assessment of Program Outcomes**

Every time after teaching a relevant course, the instructor is expected to file course and evaluation materials in the *‘Maroon’ Instructor Notebook* (it is called ‘maroon’ because of the color of the binder). The most important document in the *Instructor Notebook* is the completed *Post-Course Instructor Comment Form*, which summarizes class details, results of program outcome measurements and some general comments. A copy of the *Post-Course Instructor Comment Form* is provided in Supplementary Documentation. Other materials that instructors will file in the *Instructor Notebook* are listed below. In general, the *Maroon Instructor Notebooks* will contain information and a summary the course each semester it was taught. This provides important feedback to instructors of future course and ensures continuity. Its contents are listed below.

A complementary *‘White’ Course Notebooks* is prepared once every 6 years, just prior to *ABET* accreditation visit. The *Course Notebooks* contains a detailed summary and examples of student work for each assignment. Its contents are listed below.

Finally, there are separate *‘Blue’ Program Outcomes Notebooks*, which contains yearly reports for each of the program outcomes, among other documents (see detailed list below). Since 2010, each faculty member of the *Department of Physics* will be charged in summarizing the measurements of a program outcome. This ensures faculty involvement in the ABET assessment process. The *Program Outcomes Notebook* also contains the results of our yearly student progress reports, where progress of each student is reviewed individually. Its contents are listed below.

As a practical matter, we began keeping the notebooks online in 2008, and print them out for *ABET* assessment. Virtual notebooks are available to all faculty and are much more useful in that form. In summary, the notebooks contain the following:

**‘Maroon’ Instructor’s Notebooks** (prepared at the end of each course)

* completed *Post-Course Instructor Comment Form*.
* supporting material for Outcomes Assessment *(a-k)* (questions, tests, etc.).
* syllabus and actual schedule followed
* copies of exams, quizzes and homework, or references thereto.
* copies of other class materials

**‘White’ Course Notebooks** (prepared for *ABET* review cycle)

* course outline and syllabus
* copies of all assignments, i.e. pre-req. test, exams/labs/quizzes/homeworks/projects
* copies of student work for each assignment (typically: high/medium/low)
* hand-outs and other material used
* summary of student evaluations

**‘Blue’ Outcomes Notebooks** (prepared for *ABET* review cycle)

* Part 1: separate notebooks for each of the *Program Outcomes (a)-(k)* containing annual summaries of all outcomes measures.
* Part 2: supplementary documents, such as
  + *Post-Course Instruction Forms* for courses taught during the reporting period
  + *Senior Student Exit Interview (SSEI)*
  + summaries of *ETS-MFT* tests
  + other outcomes measures

## B. Relationship of Student Outcomes to Program Educational Objectives

*Describe how the student outcomes prepare graduates to attain the program educational objectives.*

The goal of our EP program is to design a curriculum and implement processes that prepare students for achievement of the *EP Educational Objectives 1-3*, which were already introduced in *Criterion 2*. The *EP Educational Objectives* are:

**EP Objective 1: Competitiveness.** Graduates are competitive in internationally-recognized academic, government and industrial environments;

**EP Objective 2: Adaptability.** Graduates exhibit success in solving complex technical problems in a broad range of disciplines subject to quality engineering processes;

**EP Objective 3: Teamwork and Leadership.** Graduates have a proven ability to function as part of and/or lead interdisciplinary teams.

**Table 3.3.** Relationship between EP Educational Objectives and Program Outcomes. Relationships of primary importance with a formal feedback loop are marked ‘X’, significant relationships with no formal feedback are marked ‘s’.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **EP**  **Educational**  **Objectives** | **Program Outcomes** | | | | | | | | | | |
| ***(a)***  Scientific  Expertise | ***(b)***  Experimental  Training | ***(c)***  Design  Abilities | ***(d)***  Teamwork | ***(e)***  Problem  Solving | ***(f)***  Professional  Responsibility | ***(g)***  Communication Skills | ***(h)***  Societal  Impact | ***(i)***  Life-long  Learning | ***(j)***  Contemporary Issues | ***(k)***  Technical  Know-How |
| **EP Objective 1:** | **X** | **s** | **X** |  | **X** |  |  |  |  |  | **X** |
| **EP Objective 2:** | **s** |  | **s** | **s** | **s** | **s** | **s** | **X** | **X** | **X** | **s** |
| **EP Objective 3:** |  | **X** |  | **X** |  | **X** | **X** | **s** |  |  |  |

As outlined in *Criterion 2*, for the ABET 2018 cycle, achievement of our *Educational Objectives* is seen by the success of our alumni, as indicated by employment surveys, interviews with alumni, and exit interviews with graduating students. The matrix in Table 3.3 clarifies the relationship of our *EP Educational Objectives* with the *Program Outcomes (a)-(k)*.

Each *Program Objective* maps to multiple Program *Outcomes*, and *vice versa*. We only measure the mapping of each *Program Outcome* to its primary *Education Objective* (marked with ‘**X**’ in Table 3.3). *Program Outcomes* may also map to secondary *Educational Objective(s),* but we do not formally evaluate them for that purpose (marked with ‘**s**’ in Table 3.3).

# CRITERION 4. CONTINUOUS IMPROVEMENT

This section discusses improvements of our *Engineering Physics (EP)* program during the last ABET cycle (2012-2018). In general, improvements were made as the result of a whole series of different assessment results, which can roughly be categorized into: program-quality, educational-objectives and program-outcomes assessments. The *Department of Physics* utilizes a well-defined set of approaches and tools for the different types of assessment, and their timelines are briefly summarized below.

**Program-Quality Assessment – *Tools and Timeline***

Program quality can be closely correlated with *a) quality of instruction* and *b) relevance/extent of course offerings* in the program.

The former is regularly assessed by the following means:

**Student evaluations** *(done for every course each semester)*

NMSU requires that students will be given the opportunity to fill out a student-evaluation form for each course near the end of a semester. Among others, the student evaluation has several questions about the student’s perceived quality of instruction.

**Pre-requisite tests** *(done for most of physics undergraduate courses each semester)*

The Department of Physics introduced a pre-requisite test to be given in the 1st or 2nd class period. The main goal of the pre-requisite test is to identify whether previous instruction of necessary pre-requisite material was successful.

**Faculty annual performance evaluations** *(once per year)*

Each faculty member is required to submit a performance evaluation package every year. Teaching is part of these performance evaluations and the Department Head will discuss ways to address any identified weaknesses with the faculty member*.*

In addition, there is input from our constituencies, and it is assessed in the following ways:

**Input from *Engineering Physic External Advisory Board (EPEAB)*** *(at least, every per year)*

The *EPEAB* has members from all the program’s major constituencies; faculty from other universities, scientific staff from national laboratories and from industry, and recent graduates of our program. The board meets with physics faculty and other program representatives once every year on campus. The written reports provide guidance for the EP curriculum.

**Faculty and Student Input** *(not on a regular basis, occasionally)*

The Department of Physics has limited teaching strength and therefore course offerings are often limited. On occasion, students and individual faculty members will try to accommodate additional course offerings outside of the regular curriculum.

***Program-Outcomes* Assessment – *Tools and Timeline***

The assessment of *Program Outcomes* will be discussed in detail in section *A. Program Outcomes* (see below). For their assessment, we use the following tools:

***Course Program Outcomes Assessment*** *(done for every course each semester)*

For each undergraduate course, which is or can be part of the EP curriculum (i.e. required courses or electives), the course instructors are required to measure (one or more) *Program Outcomes*, as assigned by the *Engineering Physics (EP) Outcomes Matrix*, see Table 3.2.a. in *Criterion 2 – Program Outcomes*. On occasion, instructors may volunteer additional *Program Outcomes* measures, beyond those assigned to the course. Non-compliance of providing the assigned *Course Program Outcomes* measures results in a deficiency in the faculty member’s service contribution for that year.

**Faculty *Program Outcomes* Summary Reviews** *(averaging every 2 years)*

To increase faculty participation in the *Program Outcomes* reviews, individual faculty members are assigned to provide a short summary of one individual *Program Outcome*. Summary assignments to individual faculty members are distributed in average every 2 years. In general, such summaries are due along with the *Annual Faculty Performance* reports, usually in October. Non-compliance of providing the assigned summary results in a deficiency in the faculty member’s service contribution for that year.

***Senior Student Exit Interviews (SSEI)*** *(when a student graduates from the program)*

The *Head of the Department of Physics* will perform a formal exit interview using the *Senior-Exit Interview Form* for each student in the graduating semester. The form has questions directly connected to Program Outcomes. The *Senior Student Exit Interview (SSEI) Form* is provided in *Supplementary Information*.

## A. Student Outcomes

*It is recommended that this section include (a table may be used to present this information):*

*A listing and description of the assessment processes used to gather the data upon which the evaluation of each student outcome is based. Examples of data collection processes may include, but are not limited to, specific exam questions, student portfolios, internally developed assessment exams, senior project presentations, nationally-normed exams, oral exams, focus groups, industrial advisory committee meetings, or other processes that are relevant and appropriate to the program.*

*The frequency with which these assessment processes are carried out*

*The expected level of attainment for each of the student outcomes*

*Summaries of the results of the evaluation process and an analysis illustrating the extent to which each of the student outcomes is being attained*

*How the results are documented and maintained*

Each course instructor knows which student *Program Outcomes* are assigned to be measured in each course. The instructor will design a quantitative measure for each *Program Outcome*, if none exists. Instructors’ results are documented electronically or in the *Instructors Notebooks* each time a course is taught. In 2008, we started a process, where individual faculty members are asked to summarize the findings for an individual *Program Outcome*. That way we made sure that all faculty members are not only aware but are also involved in the overall assessment process. The summaries are collected in average of 2 years and documented in the *Program Outcomes Notebook*. An example of a *Program Outcomes Assessment Summary* is provided in *Supplementary Information.*

The *Program Outcome Assessment Process* focuses on courses offered by the *Department of Physics*. In conjunction with this, assessment of required outcomes in the *Aerospace*, *Chemical*, *Electrical*, and *Mechanical Engineering* programs is conducted in the respective engineering departments as part of *ABET* accreditation for their majors (see *Criterion 3 – Program Outcomes*). Engineering faculty is represented on the *Engineering Physics (EP) Program Committee*, which helps to align the curriculum and outcomes assessment for their majors with the ones of the EP program. It should be noted that this makes for a particularly strong EP program, with *ABET Program Outcomes (a)-(k)* being assessed in multiple departments.

**Program Outcomes Assessment in the *Department of Physics***

**Note: This part of the SSR will be updated to include additional measurements from Fall 2017, and additional outcomes measures (e.g. ETS – MFT/Physics) once they are available.**

Below, we summarize the results of *Program Outcomes Assessment* of the EP program as measured in the *Department of Physics*. As mentioned above, all *Program Outcomes* were also assessed in the *Senior Student Exit Interviews (SSEI)*; these are labeled as such in the Diagrams 4.3.a-k.

***Program Outcome (a) - Scientific Expertise***

This *Program Outcome* assesses whether students understand the basic concepts, notation and techniques in fundamental disciplines of physics and engineering, such as mechanics, electromagnetism, thermodynamics and modern physics. Common assessment tools for this *Program Outcome* are: a) the nationally administered *Force Concept Inventory (FCI)* test (Hestenes, Wells, and Swackhamer, 1992; Hestenes, D., and I. Halloun, 1995); b) problems provided in the *TIPERs: Electricity & Magnetism Tasks* by C. J. Hieggelke,‎ D. P. Maloney,‎ T. L. O'Kuma,‎ Steve Kanim; c) the *Mechanics & Electricity Assessment Test (MEAT)*, d) *Mastering Physics*® skill-builder assessment tools; and e) standardized questions embedded in exams, tests or quizzes.

Typically, data are collected in 200-level physics courses each time they are taught, i.e. *PHYS 213, 214, 215G, 216G,* and *217*. We also asked exiting seniors to evaluate our impact on this outcome in the *Senior Student Exit Interviews (SSEI)*. In addition, we included the *ETS® Major Field Test in Physics* subscore for *Introductory Physics* in the assessment of this *Program Outcome* (still to be added).

Target levels are determined by individual instructors depending on the choice of the assessment tool. Instructors, utilizing nationally-administered tests or assessment tools (i.e. the *FCI* or the *Mastering Physics®* skill builder assessment) will typically use the national or system average for the determination of a target. For example, when the *Force Concept Inventory* Test is given as a pre-test at the beginning and as a post-test at the end of the course, national data show a 48% improvement, and instructors using the *FCI* as the assessment tool typically use this as the target. Justification for targets, not set by some national standards or similar, are generally provided by instructors in their individual *Post Course Instructor Comment Forms,*

The results are displayed in Diagram 4.3.a. The results indicate that the level of achievement for this *Program Outcome* is above 80% of the target. Achievement of this *Program Outcome* is determined with high confidence because of the large number of assessment tools and possible comparison with nationwide data.

*Course Program Outcomes* measurements are provided in the *Instructors Notebooks* for individual, and all *Program Outcome* measures are compiled in the *Program Outcomes Notebooks*. The contents of the two notebooks are provided at the end of this section.

***Program Outcome (b) - Experimental Training***

This *Program Outcome* is supposed to assess whether a student can perform fundamental experimental studies in physics and engineering, and he/she is able to analyze the data. Common assessment tools were: a) final laboratory exam grades or embedded exam questions; b) selected laboratory homeworks; c) individual lab reports, d) observation of student’s comfort level and/or participation in labs by teaching assistants; and e) teacher assessment of field-work participation.

Data were collected in courses that contain a laboratory component, i.e. *PHYS 213L, 214L, 215GL, 216GL, 217L, 315L, 304, 471, 475* and *493*. We also asked exiting seniors to evaluate our impact on this outcome in the *Senior Student Exit Interviews (SSEI)*.

The target level is set by instructor depending on method used. In many cases, the departmental average or the B grade value, and several instructors used this as the target value. In other cases, however, the instructor set their targets based on their expectations, see individual *Post Course Instructor Comment Forms*.

The results are shown in Diagram 4.3.b, and it is apparent that almost all results are near the target levels. Achievement of this *Program Outcome* can be determined with relatively high confindence because multiple assessment tools have been used.

*Course Program Outcomes* measurements are provided in the *Instructors Notebooks* for individual, and all *Program Outcome* measures are compiled in the *Program Outcomes Notebooks*. The contents of the two notebooks are provided at the end of this section.

***Program Outcome (c) - Design Abilities***

This *Program Outcome* assesses the student’s ability to design and implement an experimental or theoretical study to tackle physics problems in an applied context, such as economic, environmental, or societal. It was generally assessed using a) students’ *Experimental Design Reports* and b) instructor’s observations during various experimental and programming activities.

We expected data to be collected in relevant classes each time they were taught, i.e. *PHYS 315L, 471, 475, 476* and *493*. We also asked exiting seniors to evaluate our impact on this outcome in the *Senior Student Exit Interviews (SSEI)*.

The target was set by instructors who measured this *Program Outcome* at 80%, see *Post Course Instructor Comment Forms.*

As can be seen in Diagram 4.3.c, the results are close to the instructors’ expectations in all cases. Achievement of this *Program Outcome* is determined with comparatively low confindence because only few assessment tools are used.

*Course Program Outcomes* measurements are provided in the *Instructors Notebooks* for individual, and all *Program Outcome* measures are compiled in the *Program Outcomes Notebooks*. The contents of the two notebooks are provided at the end of this section.

***Program Outcome (d) - Teamwork***

This *Program Outcome* determines whether students can work as effective members of a team, and they are able to take responsibility for some or all aspects of a common goal. was typically assessed *Peer Team Evaluations* in laboratory courses. Students ranked contributions and participation of their peers on a scale of 1-4.

We expected data to be collected in assigned classes each time they were taught, i.e. *PHYS* *315L*, *471L*, *304* and *475*. We also asked exiting seniors to evaluate our impact on this outcome in the *Senior Student Exit Interviews (SSEI)*.

The targets were set by the instructors, see *Post Course Instructor Comment Forms*.

As can be seen in Diagram 4.3.d, the targets were generally met. The students usually get along well, even though there is the occasional problem. This *Program Outcomes* measure has larger scatter because the teams are typically small, i.e. statistical fluctuations are large. Moreover, achievement of this *Program Outcome* is determined with comparatively low confindence because only few assessment tools are used.

*Course Program Outcomes* measurements are provided in the *Instructors Notebooks* for individual, and all *Program Outcome* measures are compiled in the *Program Outcomes Notebooks*. The contents of the two notebooks are provided at the end of this section.

***Program Outcome (e) - Problem Solving***

This *Program Outcome* measures students’ scientific understanding and ability to solve physics and engineering problems. It was assessed almost entirely by using *Graduate Record Exam (GRE)* questions embedded into exams, tests or exams.

Data are collected in assigned classes each time they are taught, i.e. *PHYS 451*, *454*, *455*, *461*, *462*, and *480*. We also asked exiting seniors to evaluate our impact on this outcome in the *Senior Student Exit Interviews (SSEI)*. In addition, we included the *ETS® Major Field Test in Physics* subscore for *Advanced Physics* in the assessment of this *Program Outcome* (still to be added).

All course instructors used the national norm as the target for *GRE* questions. We acknowledge that the standard *GRE test* limits the time students can spend on each problem, and this is quite difficult to repeat in a regular classroom setting. Therefore, it can be expected that students would typically perform at levels above the national norm.

As can be seen in diagram 4.3.e., using *GRE* questions, targets were typically met and often exceeded. There are significant fluctuations in this measure because the number of students in these classes is small, typically between 10 and 20 students. Nevertheless, achievement of this *Program Outcome* is determined with high confidence because nationwide data are available.

*Course Program Outcomes* measurements are provided in the *Instructors Notebooks* for individual, and all *Program Outcome* measures are compiled in the *Program Outcomes Notebooks*. The contents of the two notebooks are provided at the end of this section.

***Program Outcome (f) - Professional Responsibility***

This *Program Outcome* is supposed to measure whether students demonstrate high standards of ethics and integrity in their professional activities. Some of the assessment tools of this *Program Outcome* were: a) separate subscores in essays or project reports; b) student use of citations in essays; c) attendance and participation, d) student participation and contributions to team projects; and e) external reviews of ‘professionalism’ of student presenters.

This outcome is measured each time a relevant course is taught, i.e. *PHYS 304, 315*, *315L*, *471*, *475*, *488*, and *489*. We also asked exiting seniors to evaluate our impact on this outcome in the *Senior Student Exit Interviews (SSEI)*.

Targets were set by the instructors of each course, see *Post Course Instructor Comment Forms*.

As can be seen in diagram 4.3.f, the targets were typically met. Achievement of this *Program Outcome* is determined with some confindence because multiple assessment tools were used.

*Course Program Outcomes* measurements are provided in the *Instructors Notebooks* for individual, and all *Program Outcome* measures are compiled in the *Program Outcomes Notebooks*. The contents of the two notebooks are provided at the end of this section.

***Program Outcome (g) - Communication Skills***

This *Program Outcome* measures the students’ ability to present information (both, orally and written) in an effective, well-organized, logical and scientifically-sound manner. The assessment of this *Program Outcome* was generally done using written reports in lab and lecture courses with an emphasis on writing quality and grammar, and from oral presentations.

We expected that this outcome would be measured each time a relevant course is taught, i.e. *PHYS 304, 315L, 471*, *475* and *493*. We also asked exiting seniors to evaluate our impact on this outcome in the *Senior Student Exit Interviews (SSEI)*.

Targets were set by instructors, see *Post Course Instructor Comment Forms*.

As can be seen in diagram 4.3.g, students’ communication skills are generally adequate. Achievement of this *Program Outcome* is determined with comparatively low confindence because only few assessment tools are used.

*Course Program Outcomes* measurements are provided in the *Instructors Notebooks* for individual, and all *Program Outcome* measures are compiled in the *Program Outcomes Notebooks*. The contents of the two notebooks are provided at the end of this section.

***Program Outcome (h) - Societal Impact***

This *Program Outcome* attempts to measure students’ appreciation of the human dimension and the impact of their profession in a diverse social, cultural and economic environment. Assessment of the *Program Outcome* was done: a) subscores in essays or project reports; b) specific homework assignments, and c) class participation.

This outcome was measured each time relevant classes were taught: *PHYS 315*, *488*, and *489*. We also asked exiting seniors to evaluate our impact on this outcome in the *Senior Student Exit Interviews (SSEI)*.

Targets were set by the instructors, see *Post Course Instructor Comment Forms*.

As can be seen in diagram 4.3.h, targets were generally reached. *Physics 489 - Modern Materials* was particularly relevant to this *Program Outcome*. Achievement of this *Program Outcome* is determined with comparatively low confindence because only few assessment tools are used.

*Course Program Outcomes* measurements are provided in the *Instructors Notebooks* for individual, and all *Program Outcome* measures are compiled in the *Program Outcomes Notebooks*. The contents of the two notebooks are provided at the end of this section.

***Program Outcome (i) - Lifelong Learning***

This *Program Outcome* attempts to measure students’ understanding of the need for life-long learning to accommodate rapid changes in science and technology. Assessment of the *Program Outcome* was done: a) subscores in essays or project reports; b) specific homework assignments, and c) subsores in oral presentations.

This outcome was measured each time the relevant classes were taught, i.e. Physics *304*, *315, 488*, and *489*. We also asked exiting seniors to evaluate our impact on this outcome in the *Senior Student Exit Interviews (SSEI)*.

Targets were set by instructors, see *Post Course Instructor Comment Forms*.

As can be seen in diagram 4.3.f, the results average around 80% of the target. We have always had trouble in the Achievement of this *Program Outcome*, indicating the need of more targeted effort in future courses. Achievement of this *Program Outcome* is determined with comparatively low confindence because only few assessment tools are used.

*Course Program Outcomes* measurements are provided in the *Instructors Notebooks* for individual, and all *Program Outcome* measures are compiled in the *Program Outcomes Notebooks*. The contents of the two notebooks are provided at the end of this section.

***Program Outcome (j) - Contemporary Issues***

This *Program Outcome* determines students’ preparation to become effective members of the society throughout their careers, Assessment of this *Program Outcome* was generally done using essays or project reports or presentations, either through the choice of presentation topic or separate subscores.

This *Program Outcome* was measured each time the relevant classes were taught, i.e. *Physics 304, 315*, *488*, and *489*. We also asked exiting seniors to evaluate our impact on this outcome in the *Senior Student Exit Interviews (SSEI)*.

Targets were set by instructors, see *Post Course Instructor Comment Forms*.

As can be seen in diagram 4.3.j, targets were generally met or exceeded. Achievement of this *Program Outcome* is determined with comparatively low confindence because only few assessment tools are used.

*Course Program Outcomes* measurements are provided in the *Instructors Notebooks* for individual, and all *Program Outcome* measures are compiled in the *Program Outcomes Notebooks*. The contents of the two notebooks are provided at the end of this section.

***Program Outcome (k) - Technical Know-how***

This *Program Outcome* measures students’ ability to understand how to use widely-spread state-of-the-art tools used in modern engineering practice. Assessment of this *Program Outcome* uses: a) in-lab observations in the Advanced Physics Lab courses; b) exam questions or standardized questions from the *Fundamental Engineering (FE)* exam in *Math Methods in Physics* course; and c) a final software design challenge assignment in the *Computational Physics* course.

This outcome was measured in lab courses each time they were taught, i.e. Physics 315L, 395, 471, 475, 476, and 495. We also asked exiting seniors to evaluate our impact on this outcome in the Senior Student Exit Interviews (SSEI).

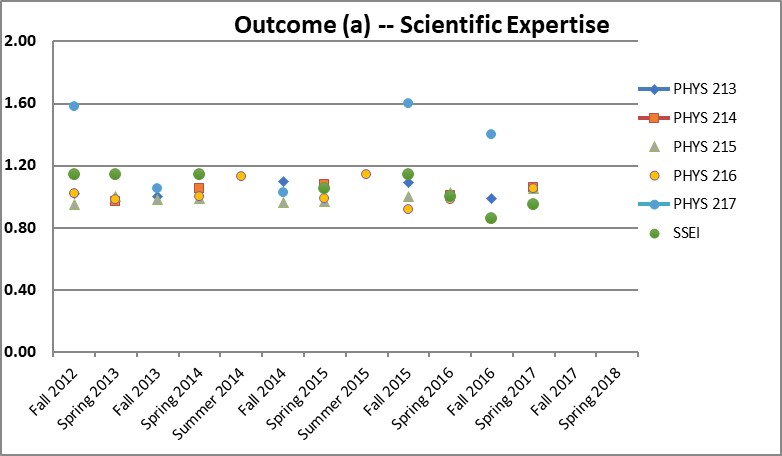
Targets were set by individual instructors, see *Post Course Instructor Comment Forms*.

As can be seen in diagram 4.3.k, targets were generally met, except for one poor performance in one semester of PHYS 395. Achievement of this *Program Outcome* is determined with comparatively low confindence because only few assessment tools are used.

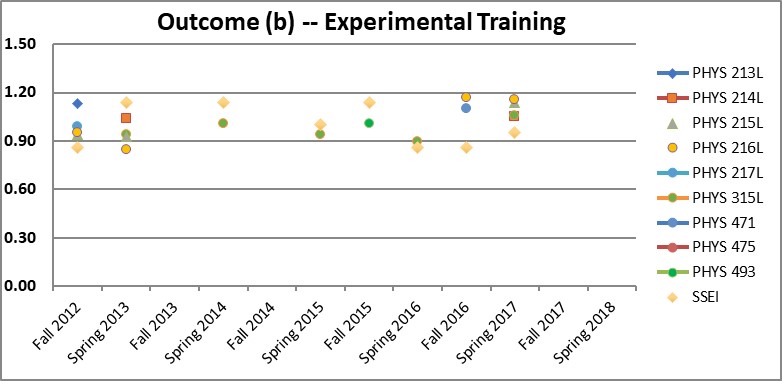
*Course Program Outcomes* measurements are provided in the *Instructors Notebooks* for individual, and all *Program Outcome* measures are compiled in the *Program Outcomes Notebooks*. The contents of the two notebooks are provided at the end of this section

Below, we display the Diagrams 4.3.a-k., which summarize the results for each of the *Program Outcomes* measurements discussed above.

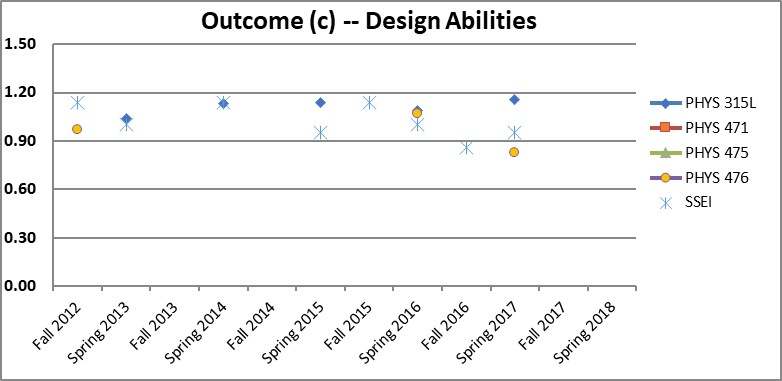
**Diagram 4.3.a.** Measured level of achievement (normalized to the stated target) of all courses for Program Outcome (a) since Fall of 2012.



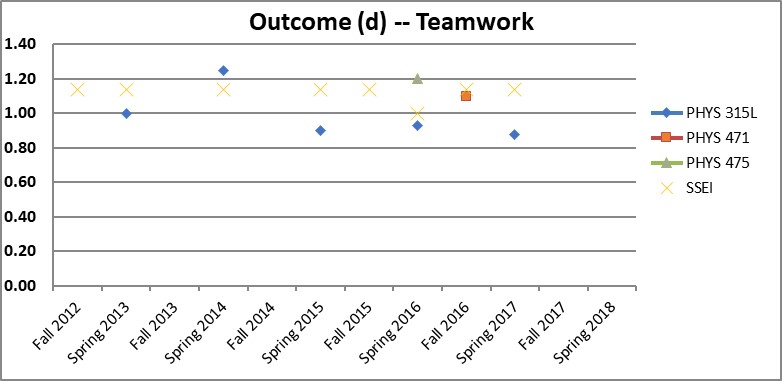
**Diagram 4.3.b.** Measured level of achievement (normalized to the stated target) of all courses for Program Outcome (b) since Fall of 2012.



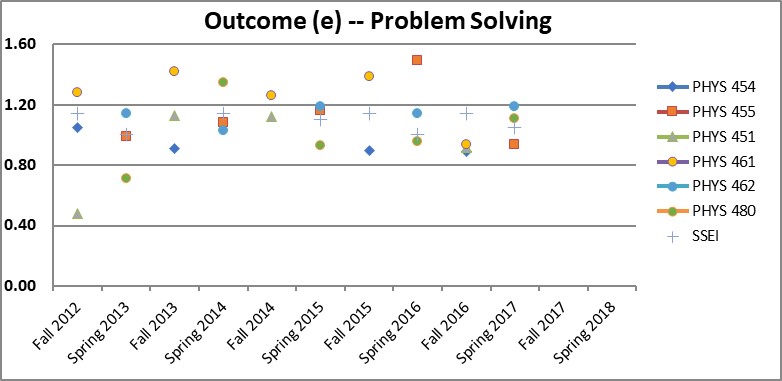
**Diagram 4.3.c.** Measured level of achievement (normalized to the stated target) of all courses for Program Outcome (c) since Fall of 2012.

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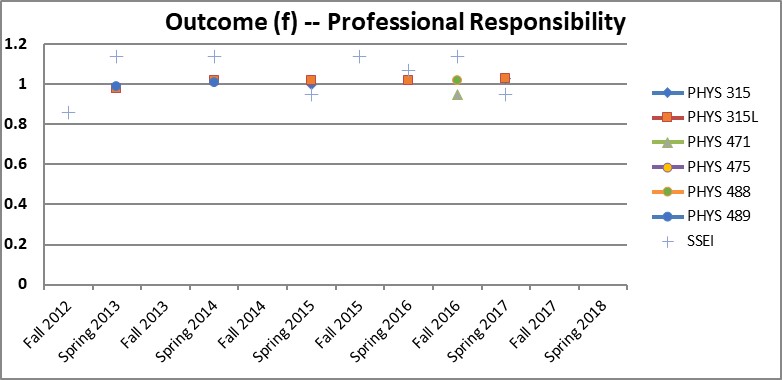
**Diagram 4.3.d.** Measured level of achievement (normalized to the stated target) of all courses for Program Outcome (d) since Fall of 2012.



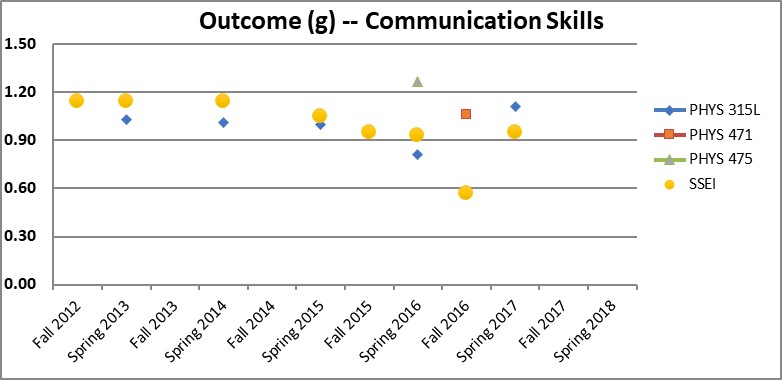
**Diagram 4.3.e.** Measured level of achievement (normalized to the stated target) of all courses (and other measures) for Program Outcome (e) since Fall of 2012.



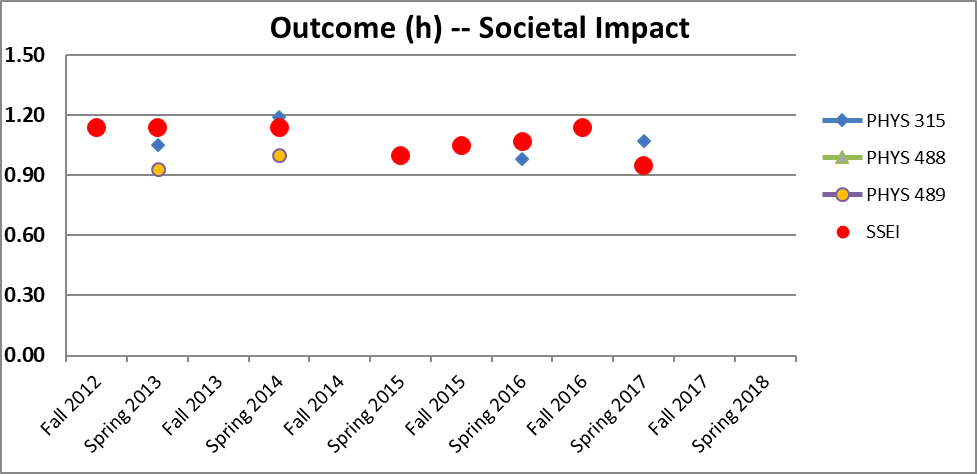
***Diagram 4.3.f.*** *Measured level of achievement (normalized to the stated target) of all courses for Program Outcome (f) since Fall of 2012.*



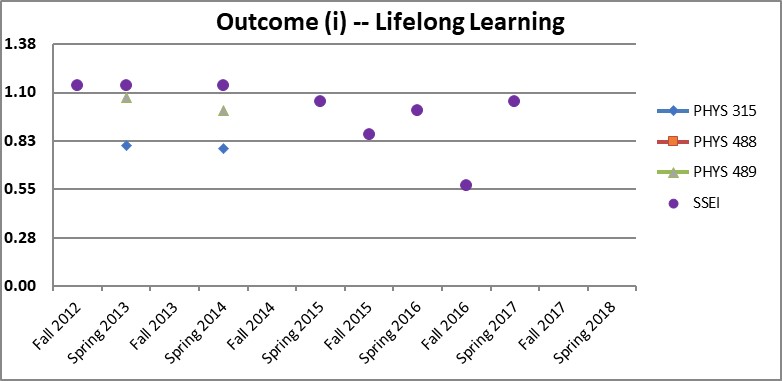
**Diagram 4.3.g.** Measured level of achievement (normalized to the stated target) of all courses for Program Outcome (g) since Fall of 2012.

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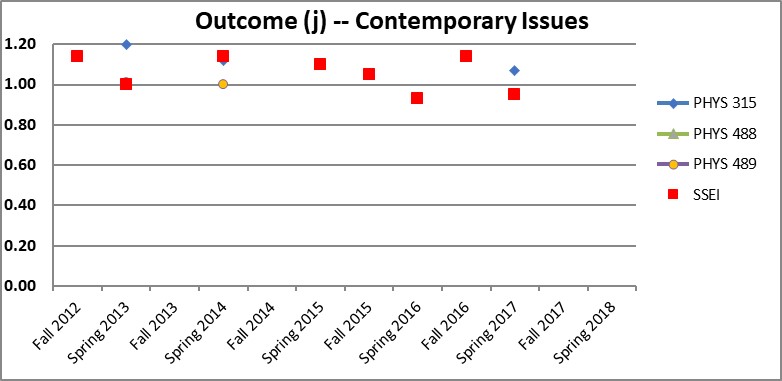
**Diagram 4.3.h.** Measured level of achievement (normalized to the stated target) of all courses for Program Outcome (h) since Fall of 2012.



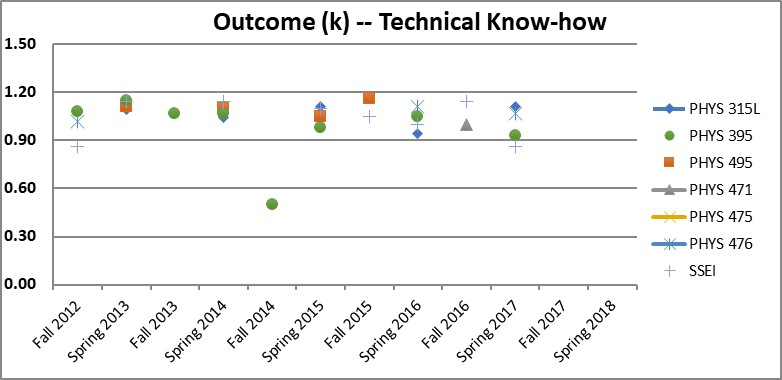
***Diagram 4.3.i.*** *Measured level of achievement (normalized to the stated target) of all courses for Program Outcome (i) since Fall of 2012.*



**Diagram 4.3.j.** Measured level of achievement (normalized to the stated target) of all courses for Program Outcome (j) since Fall of 2012.



**Diagram 4.3.k.** Measured level of achievement (normalized to the stated target) of all courses for Program Outcome (k) since Fall of 2012.



### Summaries of *Program Outcomes* Assessment of other engineering programs

To be compiled from material provided by Engineering Departments

**Mechanical Concentration**

The required ME courses of EP-ME majors, used to assess individual *Program Outcomes (a)-(k)*, are listed in the assessment matrix in Diagram 3.2.e. The assessments are reviewed by a departmental *Outcomes and Assessment Committee (OAC)* once per semester in the *Department of Mechanical & Aerospace Engineering.* Current members of the *OAC* are Drs. F. Shu, V. Choo, E. Conley, and B. Shashikanth.

No quantitative data were collected for *Program Outcomes (h) – Societal Impact* and *Program Outcome (i) – Lifelong Learning*. Meeting these *Program Outcomes* was evidenced by students’ written responses of student surveys in the *ME 449 – Senior Seminar course*, which were administered at the beginning and at the end of the semester. Other *Program Outcomes* were measured quantitatively through a variety of assessment tools in relevant ME courses (see Diagram 3.2.e.).

The collected materials and data provide the aggregate gauge that all *Program Outcomes (a)-(k)* are generally satisfied. However, a few individual courses and/or particular instructors fell short of the expected achievements. To address the shortcomings, the *OAC* closed loops based on the flowcharts, senior-exist surveys, and input from the department’s *Industrial Advisory Committee (IAC)*. The *OAC* meets once every semester in order to

1. to evaluate the results from flowchart report from each course instructor and ensure the improvement plan is adequate, and
2. to determine whether the results from previously proposed plans have been carried out and determine whether the plan’s goal has been achieved (i.e., re-assessment).

If the results are deemed inadequate, a new or revised plan may be proposed and carried out in future semesters. Another assessment tool is the senior-exit interview, where graduating students provide feedback about the quality of instruction and/or course content. Comments directed to specific faculty’s member teaching style and/or shortcomings are addressed by the department head with faculty members during the annual performance evaluation. Finally, the *OAC* takes into account the input from the *IAC*, which provides important input on necessary skills of graduates for entering job market and for success in their careers. More details on the *Program Outcomes Assessment* through ME courses can be found in the *Mechanical Engineering Self Study Report*.

## B. Continuous Improvement

Describe how the results of evaluation processes for the student outcomes and any other available information have been used as input in the continuous improvement of the program. Describe the results of any changes (whether or not effective) in those cases where re-assessment of the results has been completed. Indicate any significant future program improvement plans based upon recent evaluations. Provide a brief rationale for each of these planned changes.

Continuous improvement of the EP program over the reporting period was initiated by one of more of its stakeholders: the *College of Engineering,* the participating *Engineering Departments,* or the *Department of Physics.* Continuous improvement on the physics side of the EP program has occurred primarily in response to findings of the *Department of Physics* faculty, *EP Program Committee* and/or *EP External Advisory Board* meetings.

In this section, we discuss some of the more important changes that were implemented to improve the quality of the EP program or aspects related to the EP program (closed loops). The areas of improvement can be roughly divided into the following categories: efforts to increase retentions, course re-design & improvements, changes in the course curriculum, and instrumentation & facility upgrades. Every action taken lists the *Program Outcome(s)* that it addresses, and a.) what observation(s) caused the action, b.) previous approach and proposed changes, c.) activities of implementation, and d.) status of implementation. The closed loops are not necessarily presented in order of importance.

**Efforts to Increase Retention**

**Introduction of *ENGR 100 – Introduction to Engineering***- addresses *Program Outcomes (c), (d), (e), (f), and (g)* – initiated by the *College of Engineering*

1. *The Academic Dean of the College of Engineering felt that the low retention rate among first- and second-year engineering students needed to be addressed.*
2. *Traditionally, each engineering department has had its own “introductory” engineering course, but there was no uniform format nor any coordination between them.*
3. *ENGR 100, Introduction to Engineering, is now required of all engineering majors and should be taken by students in their first semester at NMSU. It includes an introduction to the various engineering disciplines, the engineering approach to problem-solving, the design process, teamwork, communication skills, and ethical responsibilities. The goal is to create a sense of purpose in the curriculum, and provide a start on real skill-building, from the very first day.*
4. *The change was fully implemented in Fall 2014. ENGR 100 is now required for all engineering majors, including EP. The EP curricula for all concentrations and associated flowcharts were also adjusted.*

**Peer Learning Assistants (PLAs)** *–* addresses *Program Outcomes (a), (e), and (k)* – initiated by the *Department of Physics*

1. *We sought to increase the level of tutoring provided to Physics and EP students, within the Physics department.*
2. *Research nationwide has shown that undergraduate tutors and peer learning assistants improve retention. We introduced a formal program for recruiting and training so-called Peer Learning Assistants (PLAs).*
3. *Supported with funds from the Provost, the President, and departmental resources, in FY 16/17 nine undergraduate tutors were hired at a cost of $4200. Numbers for FY 15/16 were similar. Additional students in the program are hired as tutors by other organizations on campus, such as the Math Success Center, the College of Engineering, and others.*
4. *Unfortunately, the funds for this program from the Provost’s office dried up due to budgetary reductions in the past years. But we hope to revive this program again in the future.*

**Introduction of Additional Supplemental Instruction Courses** – addresses *Program Outcomes (a) and (e)* – initiated by the *Department of Physics*

1. *We continue to note student difficulties in 200-level lecture courses, which affects learning and our retention rate.*
2. *We first introduced “supplemental instruction” in Fall 2012, for just one course, PHYS 213 Mechanics, in the form of a 1-credit work session focusing on problem-solving strategies.*
3. *Now we have supplemental instruction courses for PHYS 213, 214, 215, 216, 217 and 315. These are not required courses but we encourage students to take them to improve their problem-solving skills.*
4. *All supplemental instruction courses have been in place starting Fall 2017.*

**MATH tutoring by a Physics Teaching Assistant** – addresses *Program Outcomes (a) and (e)* – initiated by the *Department of Physics*

1. *Some incoming freshmen struggle with the Introductory Calculus, MATH 191 or MATH 192, sequence, or don’t have the high-school preparation to enroll in that sequence. This also affects whether incoming students can enroll into Intro Physics courses.*
2. *While the Math Department and the College of Arts & Sciences offer their own MATH tutoring, it is beneficial to bring students into the department as early as possible. That way, EP students feel that they belong to the program.*
3. *Using departmental funds, the Department of Physics supports a Physics Teaching Assistant, who will provide some MATH tutoring free of charge for incoming students in their freshmen and sophomore year.*
4. *Support of a Physics TA for MATH tutoring started in Fall of 2016 and is continuing.*

**Support for activities of the Society of Engineering and Physics (SEPh)** *–* addresses *Program Outcomes (f), (h), (i), and (j)* – initiated by the *Department of Physics*

1. *It is important to have intramural student groups that build relationships among students, promote civil teamwork, and improve retention.*
2. *SEPh was formed in 2010 to address a concern of our EP students that they didn’t have their own student group; they felt the local Society of Physics Students (SPS) chapter did not serve their needs.*
3. *The level activity in SEPh depends somewhat on the student membership. Recently they have been very active and we have supported their restoration of an old telescope (2016) and the Department’s Foucault pendulum (2017), and the construction of a 3D printer (2017).*
4. *The Department supported these efforts via purchases of equipment with departmental funds.*

**Support for undergraduates to attend scientific conferences** *–* addresses *Program Outcomes (f), (g), (h), and (i)* – initiated by the *Department of Physics*

1. *This is part of our continuing effort to expose undergraduates to up-to-date research.*
2. *To raise interest in physics overall, especially the idea of research and careers in physics, the department supports students attending physics conferences financially, usually with $150 per student and conference. Together with support from other sources, students are usually able to cover all costs of attending a regional physics or applied physics conference.*
3. *A large contingent of NMSU students attended the APS Four Corners meeting in Tempe AZ in Fall 2015. In the fall of 2016, the department hosted the Section Meeting of the Four Corners and Texas Sections of the American Physical Society (APS) in Las Cruces, where students in our program could interact with students and professors from other institutions in the region. To increase the retention of women, the department promotes the annual APS Conferences for Undergraduate Women in Physics, especially to our freshmen and sophomores. Several of our students attend each year. In Fall of 2017, a group of NMSU students attended the APS Four Corners meeting in Ft. Collins CO.*
4. *This is a continuing program.*

**Increased access to scholarships** *–* addresses *Program Outcomes (f) and (i)* – initiated by the *Department of Physics*

1. *Previously, the EP program did not have the same access to College of Engineering scholarships as other Engineering majors.*
2. *The Physics Department has extensive endowments, but with increased enrollment between the Physics and Engineering Physics programs we felt unable to serve all our students. The College of Engineering has a scholarship committee but our program was not represented on this committee.*
3. *Dr. Heinz Nakotte now serves on the College of Engineering Scholarship committee and as a result several of our students have received scholarships directly from the College of Engineering. Also, independently, the Physics Department started its own Engineering Physics Scholarship.*
4. *Dr. Nakotte started to serve on this committee in 2016. The EP Scholarship was also started in 2016.*

**Course Re-Design & Improvements**

**Introduction of Matlab into PHYS 315L and other elective courses** – addresses *Program Outcomes (e) and (k)* – initiated by the *Department of Physics*

1. *For the longest time, there disconnect between the computational instruction in the College of Engineering (largely Matlab-based) and that in the Physics department (either non-existing or Fortran-based).*
2. *The PHYS 150 Elementary Computational Physics course is required of Physics majors only; Engineering Physics majors usually get introductory computational training in their respective engineering departments, and this is increasing Matlab-based. The Physics department did not have any Matlab capabilities.*
3. *The Physics Department purchased a 25-seat license for Matlab for use in the PHYS 315L Experimental Modern Physics class and in the physics computer lab for use in other courses that have computational projects (PHYS 476 Computational Physics for example).*
4. *We first employed Matlab in the Physics department in Fall 2014. More recently, the University has purchased a campus license (Fall 2017). Matlab is now in regular use among our Physics and Engineering Physics students, and in the PHYS 150, 315L, and 476 classes.*

**Continual modification of *PHYS 395 Intermediate Mathematical Methods of Physics* course to meet student needs** -- addresses *Program Outcomes (a), (e), and (k)* – initiated by the *Department of Physics*

1. *We introduced the PHYS 395 course in Spring 2010 to give our students additional mathematical training as they made the transition from the elementary use of mathematical tools in the 200-level physics courses to the more advanced level required in 400-level courses.*
2. *After a few semesters we learned which topics, and at which level of instruction, were of most concern to the students and of most need in the 400-level physics sequence.*
3. *Adjustments were made in the ordering and emphasis of the topics; vector calculus, complex numbers, linear algebra, and differential equations.*
4. *We have settled on offering this course in the fall of the junior year, and we ask the instructor to present material on vector calculus first since this is the first material the students are likely to see in the 400-level courses they typically take that year.*

**Increased faculty involvement in 200-level instructional laboratory courses** *–* addresses *Program Outcome (b)* – initiated by the *Department of Physics*

1. *Faculty were not strongly involved in the 200-level instructional laboratory courses and the department began to feel that these courses were not moving forward.*
2. *For many years the “instructor of record” of the 200-level introductory lab courses (213L, 214L, 215L, and 216L) was the physics department laboratory coordinator, a staff member with a Master’s or Ph.D. in physics. This staff member supervised undergraduate and graduate students to setup and operate the lab courses. The development of these courses came to a halt and the reporting required for continual improvement was irregular.*
3. *When the lab coordinator resigned and went to another institution, we took the opportunity to reform the operation of these labs. A regular faculty member will be the instructor of record and will also be the TA of one of the lab sections.*
4. *This reformed program started in Fall 2016.*

**Introduction of new experiments in the 200-level instructional lab courses** *–* addresses *Program Outcome (b)* – initiated by the *Department of Physics*

1. *It is desired to improve the pedagogical function of the experiments in the 213L, 214L, 215L, and 216L lab courses.*
2. *Many of the same experiments were done year after year, while new technology allows for better experiments that more directly illustrate the physics concepts of interest.*
3. *We purchased new experiments to educate the students in Ballistic Motion, Archimedes Law, Oscilloscope Function, and RC Circuits. Also, the scheduling of these labs was modified.*
4. *These changes took place starting in Fall 2016.*

**Increasing the engineering content in PHYS 461 & 462** – addresses *Program Outcome (e)* and *(j)* – initiated by the *Department of Physic*

1. *The courses on Intermediate Electricity & Magnetism I and II, PHYS 461 and PHYS 462, are required for all physics and most of the EP majors. Like many other physics programs, we use Griffiths’ textbook on Introduction to Electrodynamics, which is established as a standard textbook these courses. The main mode of delivery in Griffiths textbook is in terms of fundamental physics of electrodynamics, with only few select (and more traditional) engineering applications. In 2016, some concerns were raised as to whether students taking these two courses get sufficient exposure to modern engineering concepts in that field*.
2. *The instructors agreed to increase the engineering content in those two courses either by including engineering-type homework problems or requiring engineering-type project reports.*
3. *Aside from the fundamental Griffiths textbook, the course instructors have introduced Balanis’ textbook on Engineering Electrodynamics as a second recommended read to these courses. This textbook is used for homework problems and projects with significant engineering components.*
4. *Supplementary engineering components were introduced starting in Spring of 2017, and it will continue to be a required component in PHYS 461 and 462.*

**Changes in the Course Curriculum**

**Plans for an Engineering-Wide Capstone Course** – addresses *Program Outcomes (c), (d), and (e) –* initiated by the *Department of Physics* and the *Department of Aerospace & Mechanical Engineering*

1. *The EP Program Committee has long noted the difficulties presented by the various capstone courses in the various engineering departments. While EP students for the Aerospace, Electrical and Mechanical Concentrations fulfill all pre-req requirements to participate in the engineering capstones of their respective concentrations, none of the EP students would fulfill the pre-req requirements to participate in a capstone in another engineering department. A frequent observation is that EP students of different concentrations develop interest to participate in the same common capstone, regardless of their individual concentrations, which was not possible with a current capstone system that was in place. The situation was even more complication for EP students with the Chemical Concentration, who would need to take an additional 9 credits to satisfy the capstone pre-reqs in the Chemical & Materials Engineering.*
2. *Traditionally, each engineering department had their own Capstone Course, but there was no uniform protocol or set of prerequisite courses. This presented a difficulty for interdisciplinary student teams – which capstone course should they sign up for, and how will the meet the prerequisites?*
3. *A proposal was developed by Dr. Heinz Nakotte of Engineering Physics and Dr. Gabe Garcia of Mechanical Engineering, to offer a single engineering-wide capstone course, with the ENGR prefix (such as, ENGR 400), that would serve for all engineering students. A precedent was set with the introduction of ENGR 100. Students of any engineering discipline could enroll in the engineering-wide capstone as long the students fulfill the pre-req requirements for a capstone in their engineering major; EP pre-reqs would be considered satisfied with the students taking PHYS315L and the Advanced Physics Lab. The idea was proposed to the College of Engineering and all its departments, and there seemed to be broad support across all entities. One advantage of such an engineering-wide capstone is the possibility of true interdisciplinary capstone.*
4. *A pilot project (Mini-Baja capstone in Mechanical and Electrical Engineering) was started in Fall 2017 with the goal to see how a single capstone course would function. Moreover, the College of Engineering is seeking to secure funds for a coordinator for a college-wide capstone coordinator.*

**Introduction of Additional Advanced Labs in Physics** – addresses *Program Outcomes (b), (c), (d), (f), (g), and (k)* – initiated by the *Department of Physics*

1. *For several semesters recently, the Physics Department only offered a single 400-level advanced laboratory course, PHYS 475; students commented about the lack of choices.*
2. *In the more distant past there had been optics and nuclear physics lab courses. The optics lab course had fallen by the wayside due to the retirement of one of our faculty members, and the nuclear physics lab course was temporarily combined into the curriculum of the PHYS 475 course.*
3. *It was decided to restore the PHYS 493 Experimental Nuclear Physics and PHYS 471 Modern Experimental Optics courses. Increases in enrollment meant that these courses would be viable, and this would provide students with more choices and more flexibility in scheduling.*
4. *The PHYS 493 course started up again in Fall 2013, and PHYS 471 was offered in Fall 2016.*

**Introduction of additional upper-division elective courses** *–* addresses *Program Outcomes (a), (e), and (k)* – initiated by the *Department of Physics*

1. *Some of the EP curricula include upper-division “technical electives” but students have complained about a lack of useful choices.*
2. *The purpose of the technical electives is to allow the students to round out their studies by exploring topics in which they have an interest. Students have expressed interest in areas where no existing course is relevant.*
3. *We introduced several “one-off” courses based on expressed student interest. Some recent examples are: (1) an “Arduino” electronics course, where the students built circuits centered on these cheap miniature processors; (2) an “X-ray” course where the students learned the physics that can be explored using x-rays as a probe; (3) a course in “scattering theory” that went beyond what was usually taught in the quantum mechanics, electromagnetism, and classical mechanics courses.*
4. *None of these courses were intended to be permanent additions to the catalog, and were taught under “special studies” course numbers. Instead, we will continue to listen to the students and try to respond to their needs as best we can.*

**Evolution of engineering curricula for all four EP** *–* addresses *all Program Outcomes* – initiated by participating *Engineering Departments*

1. *No curriculum can be static and serve the changing needs of students. When the University changed its minimum credit-hour requirements from 128 to 120, all engineering programs explored whether they would be able to adjust their individual curricula and course offering such that it would not jeopardize their accreditation.*
2. *While most engineering programs at NMSU, including EP, decided that they could not transition to 120 credits for their major, all four corresponding programs in the College of Engineering (Mechanical, Electrical, Chemical and Aerospace) have made significant changes to their major curricula and course offerings as a result. These changes affected the EP program as well.*
3. *The actual changes made are too numerous to list in this format; details can be found in the individual SSRs of the affiliated engineering programs. More relevant is the process whereby we meet with representatives of the four corresponding engineering programs to learn the motivations behind their changes and how we can best respond. We always worked to keep the number of credit hours as close to 128 as possible; we have not yet seen a way to get down to 120 credit hours; we await the outcome of an ongoing state-wide reform of the Common Core system.*
4. *The new Common Core system should be ready within a year, and at that point we will know how to adjust our curriculum to reduce the number of hours to be as close to 120 as we can.*

**Support for “experiential learning” from the Board of Regents** *–* addresses *Program Outcomes (f), (h), (i), and (j) –* with participation of Dr. Zollner from the *Department of Physics*

1. *The NMSU Board of Regents expressed a desire that all students have a defined “experiential learning” opportunity during their time at NMSU.*
2. *A bill concerning this topic was put before the NMSU Faculty Senate in Fall 2017.*
3. *This does not actually drive any change in our program, because our students already have experiential learning opportunities in the advanced laboratories and engineering capstone projects.*
4. *We look forward to demonstrating that our students have always had these opportunities.*

**Instrumentation & Facility Upgrades**

**Use of *Arts & Sciences Equipment Funds* and *Engineering* *Student Technology Fees*, to improve instructional laboratory equipment** –addresses*Program Outcomes (b), (c), and (e)* – initiated by the *Department of Physics* with help from the *Colleges of Arts & Sciences* and the *College of Engineering*

1. *There is always a need to maintain, repair or replace instructional lab equipment that is faulty or out-of-date.*
2. *Part of our assessment program for the instructional labs is to identify equipment that needs to be replaced. Usually the replacement should be motivated by a desire to improve the pedagogical aspect of the laboratory, rather than by a search to find an identical item.*
3. *Both, Arts & Sciences instructional funds and Engineering student fees, were used to fund purchases of computers, flat-screen monitors, sensor interfaces, oscilloscopes, power supplies, metals samples for Hall Effect measurements, neon tubes for the Franck-Hertz experiment, miniature UV-VIS-IR spectrometers, precision voltmeters and ammeters, and a state-of-the art high-purity germanium crystal gamma-ray detector. This fee also pays user fees for high tech equipment (x-ray diffractometer, electron and atomic force microscopes) that advanced laboratory students use.*
4. *These items are in current use in the introductory 200-level labs, the 315L lab and the Advanced Physics Labs.*

**Card-reader access to *Department of Physics* facilities after hours** –addresses*Program Outcomes (f) -* initiated by the *Department of Physics*

1. *Most students prefer having access to departmental facilities, such as the Computer Lab, particularly when working on projects as a team.*
2. *In general, students’ time during regular working hours is limited because of courses and/or labs, i.e. teams working on joint projects prefer access to departmental facilities after hours, which are often the only common times where all team members can meet.*
3. *All EP students in good standing will be provided with key card access to some of the departmental facilities, such as the Computer room. Students who have completed all necessary safety training may be provided with access to some experimental (research) facilities as well, although a strict 2-person rule in enforced for after-hours work.*
4. *Access permissions for undergraduate students to some of the departmental facilities was implemented a few years ago, and they continue to be granted based on need.*

## C. Additional Information

*Copies of any of the assessment instruments or materials referenced in 4.A and 4.B must be available for review at the time of the visit. Other information such as minutes from meetings where the assessment results were evaluated and where recommendations for action were made could also be included.*

Most of the material will be available in electronic form. In addition, hard copies of display materials include several sets of folders and binders, all of which have been introduced already in *Criterion 2- Educational Objectives* and *Criterion 3- Program Outcomes*. There will be four different sets of binders: the instructor’s, the course, the outcomes and the objectives notebooks. The contents of the different binders are summarized below. Textbooks, manuals and other materials are also available during the ABET review visit.

**‘Maroon’ Instructor’s Notebooks** (prepared at the end of each course)

completed *Post-Course Instructor Comment Form*.

* supporting material for Outcomes Assessment *(a-k)* (questions, tests, etc.).
* syllabus and actual schedule followed
* copies of exams, quizzes and homework, or references thereto.
* copies of other class materials

**‘White’ Course Notebooks** (prepared for *ABET* review cycle)

course outline and syllabus

* copies of all assignments, i.e. pre-req. test, exams/labs/quizzes/homeworks/projects
* copies of student work for each assignment (typically: high/medium/low)
* hand-outs and other material used
* summary of student evaluations

**‘Blue’ Outcomes Notebooks** (prepared for *ABET* review cycle)

* Part 1: separate notebooks for each of the *Program Outcomes (a)-(k)* containing annual summaries of all outcomes measures.
* Part 2: supplementary documents, such as
  + *Post-Course Instruction Forms* for courses taught during the reporting period
  + *Senior Student Exit Interview (SSEI)*
  + summaries of *ETS-MFT* tests
  + other outcomes measures

**‘Black’ *Eduational Objectives* Notebook** (filled in as needed)

* *Engineering Physics (EP) Program Committee* meeting minutes
* *Engineering Physics External Advisory Board (EPEAB) Reports* and meeting minutes
* summaries of *Alumni Surveys*
* other relevant information

# CRITERION 5. CURRICULUM

## A. Program Curriculum

*Complete Table 5-1 that describes the plan of study for students in this program including information on course offerings in the form of a recommended schedule by year and term along with maximum section enrollments for all courses in the program for the last two terms the course was taught. If there is more than one curricular path or option for a program, a separate Table 5-1 should be provided for each path or option. State whether the institution operates on quarters or semesters.*

The curricula for all EP concentrations are designed such that EP majors take approximately equal portions of physics courses, together with their physics peers, and engineering courses, together with the engineering peers of their respective concentrations, to fulfill their major requirements. In other words, there are no courses that are specifically designed and taught to EP students only. Typically, EP major complete the major-design experience (capstone) requirement within an engineering department.

There have been significant changes to the EP curriculum, compared to the 2012 SSR of the EP program. Particularly, there was a complete overhaul of the curricula for the majors in *Chemical Engineering* and *Electrical Engineering*, which greatly affected the EP curricula with those concentrations. For those engineering subjects, some courses were eliminated, others were combined and new ones were introduced. Although not as wide-ranging, there were also some changes in the requirements for *Mechanical Engineering* and *Aerospace Engineering*, some of which were adopted for EP majors with those concentrations. Compared the 2012 SSR, the physics content remained largely unchanged, with just a few changes in course contents, delivery methods and/or streamlining of assessment processes.

Table 5.1 provides a list of required and elective courses and their classification as *Math & Basic Sciences*, *Engineering*, *General Education* or *Viewing the Wider World*. The classification of each course is consistent with its classification for any of the engineering majors at NMSU.

In collaboration with the associated engineering departments, the *EP Program Committee* engaged in a continuous effort on the evaluation and needed modifications of mostly upper-level physics courses, such that they could be counted toward the contingent of ‘engineering’ courses, without adversely affecting the basic-physics knowledge that physics majors are expected to have after taking such courses. This has been an important process since the 2012 SSR, where the distinction between basic sciences and engineering for physics courses was raised as a concern by *ABET*. A discussion of the classification of physics courses is provided below.

***Physics courses counting toward science contingent in Table 4.1***

All EP students are required to take *PHYS 213/213L* or *PHYS215G/215GL*, *PHYS 214/214L* or *PHYS 216/216GL*, and *PHYS 217/217L*. The former two sets of courses and their associated labs are required courses for most engineering majors; they can be counted toward the *State’s General Education – Area III (Laboratory Science experience).* For all engineering majors, these courses count toward their Math & Basic Sciences contingent.

*PHYS 395 (Math Methods in Physics)*, *PHYS 454* and *PHYS 455* *(Intermediate Modern Physics I and II)* are required for all EP majors, *PHYS* 451 (Mechanics) is required for EP students with the *Aerospace and Mechanical Concentrations*, and *PHYS 480 (Thermodynamics and Statistical Physics)* is required for EP students with the *Electrical Concentration*. These courses are currently taught such that the focus is mostly on the fundamental physics phenomena and theoretical/mathematical approach treatment of those. Therefore, these courses count toward the general *Math & Science* contingent in Table 5.1.

To make scheduling more flexible for EP students with the *Mechanical Concentration*, they can choose between *M E 333* (counts toward engineering) or *PHYS 451* (counts toward Math & Sciences).

***Physics courses with significant engineering components***

*PHYS 315/315L* and *PHYS 461* are required courses for all EP majors. *PHYS 462* is required for all EP majors, except those with the *Electrical Concentration*, who can choose between this course and *EE 351*. An *Advanced Physics Laboratory*, i.e. *PHYS 471*, *PHYS 475* or *PHYS493*, is required for EP students with the *Chemical* or *Electrical Concentrations.*

*PHYS 315* is the *Modern Physics* course and *PHYS 315L* is its associated laboratory. One third of the course teaches modern-physics applications, such as *Solid-State Physics* (including structure characterization, magnetic materials, superconductors and semiconductors) and *Nuclear Physics* (including particle detectors, nuclear fission and fusion). The lab consists of experiments related to modern-physics phenomena and students are required to design, complete and present on a more challenging study as their final assignment. The *Department of Chemical and Materials Engineering* have accepted *PHYS 315* and *PHYS 315L* in a list of *Technical Electives* for their *Minor in Materials Engineering*.

*PHYS 461* is a course on electrostatic and magnetostatics. The engineering content of that course was expanded in recent years, and it now includes homework assignments and/or projects focused on engineering applications. The *Department of Electrical and Computer Engineering* accepts *PHYS 461* as a *Technical Elective* for their *Minor in Electrical Engineering*.

*PHYS 462* is the continuation of *PHYS 461* with a focus on electrodynamics. Like *PHYS 461*, the engineering content of *PHYS 462* was recently expanded, and it would also count as a *Technical Elective* toward a *Minor in Electrical Engineering*.

The *Department of Physics* currently offers three upper-level *Advanced Physics Laboratories*, all of which are cross-listed with the equivalent 500-level graduate labs: *PHYS 471/571* is an Optics Laboratory, *PHYS 475/575* a Solid-State Physics Laboratory and *PHYS 493.593* a Nuclear Physics Laboratory. In each of the labs, the undergraduate and graduate students work together on the same set of experiments and/or projects; however, the graduate students get more difficult assignments and expectations are slightly higher. The main reason for cross-listing is to meet the minimum enrollment requirements for courses to run, i.e. enrollment minimum equals to 10 and each graduate students count double. Each of the *Advanced Physics Laboratories* consists of experiments related to its emphasis, capped by project report and presentation. Since each of the *Advanced Physics Laboratories* has stringent project reporting requirement and some project-management component, the EP program accepts passing the *Advanced Physics Laboratory* as an alternative to passing all pre-requisite requirements for the *Senior-Design (Capstone) Course*. This is particularly important for EP majors with the *Chemical Concentration*, who typically don’t fulfill the pre-requisite requirements imposed to *Chemical Engineering* majors. The *Advanced Physics Laboratories* are accepted as *Technical Electives* for both, the *Minor in Materials Engineering* and the *Minor in Electrical Engineering.*

Several upper-level cross-listed physics courses offered by the *Department of Physics* contain significant engineering components as well, and they are accepted *Technical Electives* of various engineering minors. The following courses are offered as electives: *PHYS 467/567* *(Nanoscience and Nanotechnology), PHYS 468/568 (Elements of X-ray Diffraction), PHYS 473/473 (Optics), PHYS 476/576 (Computational Physics), PHYS 477/577 (Fiber Optic Communication Systems), PHYS 478/578 (Fundamentals of Photonics), PHYS 479/579 (Lasers and Applications), PHYS 488/588 (Condensed Matter Physics), PHYS 489/589 (Introduction to Modern Materials), PHYS 491/591 (High-Energy Physics)* and *PHYS 497/*597 (Introduction to Plasma Physics). Several of those courses are cross-listed with courses in different engineering departments (see Appendix A: Syllabi)

***Physics courses counting toward Viewing-the-Wider-World (VWW) courses***

NMSU requires all the majors to take the equivalent of two *VWW* courses. These courses should not be counted toward either the Math & Sciences or Engineering contingents for ABET purposes. However, these courses can provide data for *Program Outcomes Assessment*, if such assessments have been implemented by the instructors of such courses.

The *Department of Physics* has offered some *VWW* courses in recent years, such as *PHYS 303V (Energy and Society), PHYS 304 (Forensic Physics)* and *PHYS 305V (Search for Water in the Solar System)*.

***Substitutions, Exceptions and Waivers***

Each of the departments involved in the EP program (*Physics, Aerospace & Mechanical Engineering, Chemical & Materials Engineering, Electrical & Computer Engineering*) perform their own separate scheduling of courses for their respective majors. This leads to often unavoidable time conflicts for courses that EP students are required to take. In many cases, however, the students and their advisors may be able to identify alternative scheduling or other courses that may be considered as equivalent. The *College of Engineering* implemented a system *Exception-Ease*, where EP advisors may submit substitution or exception requests for approval to the *Academic Dean of the College of Engineering* for consideration and approval. Aside from substitutions/exceptions of majors courses, the most common substitutions are the 9-credit rule to substitute for one of the *VWW* course or transfer credits from another institution. *Exception-Ease* also allows requests for waivers; however, waivers are granted only under very unusual circumstances.

Tables 5.1.a-d provide the plan of study for each of the four EP concentrations (in alphabetical order), namely *Aerospace*, *Chemical*, *Electrical* and *Mechanical*. NMSU operates on a semester system with spring and fall semesters of approximately 14 weeks of instruction each. For some of the lower-level courses, students also can take classes during summer.

**Table 5.1.a.** Curriculum for Bachelor of Science in Engineering Physics – Aerospace Concentration (130 credits)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course (Department, Number, Title)**  **List all courses in the program by term starting with first term**  **of first year and ending with the last term of the final year.** | | **Indicate Whether Course is Required, Elective, or a Selective Elective by an R, an E or an SE1** | ***Subject Area (Credit Hours)*** | | | | | | **Last Two Terms the Course was Offered:**  **Year and,**  **Semester, or**  **Quarter** | **Maximum Section Enrollmentfor the Last Two Terms the Course was Offered2** |
| **Math & Basic Sciences** | | **Engineering Topics**  **Check if Contains Significant Design (√)** | | **General Education** | **Other (VWW)** |  |
| **Year 1, Semester 1 (15 credits)** | |  |  | |  | |  |  |  |  |
| MATH 191G, Calculus and Analytic Geometry I | | R | 4 | |  | |  |  | F 2017  S 2018 | 40  40 |
| PHYS 213 (or 215), Mechanics | | R | 3 | |  | |  |  | F 2016  F 2017 | 22  18 |
| PHYS 213L (or 215L), Experimental Mechanics | | R | 1 | |  | |  |  | F 2016  F 2017 | 22  18 |
| ENGR 100, Introduction to Engineering | | R |  | | 3 | |  |  | F 2017  S 2018 | 32  16 |
| ENGL 111G, Rhetoric and Composition | | R |  | |  | | 4 |  | F 2017  S 2018 | 27  27 |
| **Year 1, Semester 2 (18 credits)** | |  |  | |  | |  |  |  |  |
| MATH 192G, Calculus and Analytic Geometry II | | R | 4 | |  | |  |  | F 2017  S 2018 | 40  40 |
| PHYS 214 (or 216), Electricity and Magnetism | | R | 3 | |  | |  |  | S 2017  S 2018 | 21  12 |
| PHYS 214 (or 216L)L, Electricity and Magnetism Laboratory | | R | 1 | |  | |  |  | S 2017  S 2018 | 21  12 |
| M E 240, Thermodynamics | | R |  | | 3 | |  |  | F 2017  S 2018 | 46  50 |
| CHEM 111G (or 115G), General Chemistry | | R | 4 | |  | |  |  | F 2017  S 2018 | 142  166 |
| Written Communications Elective | | SE |  | |  | | 3 |  | F 2017  S 2018 | n/a  n/a |
| **Year 2, Semester 3 (16 credits)** | |  |  | |  | |  |  |  |  |
| MATH 291G, Calculus and Analytic Geometry III | | R | 3 | |  | |  |  | F 2017  S 2018 | 40  40 |
| PHYS 217, Heat, Light, and Sound | | R | 3 | |  | |  |  | F 2016  F 2017 | 28  29 |
| PHYS 217L, Experimental Heat, Light, and Sound | | R | 1 | |  | |  |  | F 2016  F 2017 | 15  16 |
| M E 236, Engineering Mechanics I | | R |  | | 3 | |  |  | F 2017  S 2018 | 48  45 |
| M E 261, Mechanical Engineering Problem Solving | | R |  | | 3 | |  |  | F 2017  S 2018 | 95  95 |
| Oral Communication Elective | | SE |  | |  | | 3 |  | F 2017  S 2018 | n/a  n/a |
| **Year 2, Semester 4 (18 credits)** | |  |  | |  | |  |  |  |  |
| MATH 392, Introduction to Ordinary Differential Equations | | R | 3 | |  | |  |  | F 2017  S 2018 | 40  40 |
| PHYS 315, Modern Physics | | R |  | | 3 | |  |  | S 2017  S 2018 | 32  33 |
| PHYS 315L, Experimental Modern Physics | | R |  | | 3 | |  |  | S 2017  S 2018 | 15  16 |
| M E 237, Engineering Mechanics II | | R |  | | 3 | |  |  | F 2017  S 2018 | 53  43 |
| C E 301, Mechanics of Materials | | R |  | | 3 | |  |  | F 2017  S 2018 | 44  59 |
| General Education Core Elective | | SE |  | |  | | 3 |  | F 2017  S 2018 | n/a  n/a |
| **Year 3, Semester 5 (18 credits)** | |  |  | |  | |  |  |  |  |
| PHYS 395, Intermediate Math. Methods of Physics | | R | 3 | |  | |  |  | F 2016  F 2017 | 12  11 |
| PHYS 461, Intermediate Electricity and Magnetism I | | R |  | | 3 | |  |  | F 2016  F 2017 | 17  15 |
| A E 339, Aerodynamics I | | R |  | | 3 | |  |  | F 2016  F 2017 | 40  37 |
| A E 362, Orbital Mechanics | | R |  | | 3 | |  |  | F 2016  F 2017 | 47  46 |
| A E 364, Flight Dynamics and Controls | | R |  | | 3 | |  |  | F 2016  F 2017 | 41  45 |
| General Education Core Elective | | SE |  | |  | | 3 |  | F 2017  S 2018 | n/a  n/a |
| **Year 3, Semester 6 (15 credits)** | |  |  | |  | |  |  |  |  |
| PHYS 462, Intermediate Electricity and Magnetism II | | R |  | | 3 | |  |  | S 2017  S 2018 | 13  13 |
| M E 345, Experimental Methods I | | R |  | | 3 | |  |  | F 2017  S 2018 | 55  62 |
| A E 363, Aerospace Structures | | R |  | | 3 | |  |  | S 2017  S 2018 | 45  48 |
| A E 439, Aerodynamics II | | R |  | | 3 | |  |  | S 2017  S 2018 | 49  45 |
| General Education Core Elective | | SE |  | |  | | 3 |  | F 2017  S 2018 | n/a  n/a |
| **Year 4, Semester 7 (15 credits)** | |  |  | |  | |  |  |  |  |
| PHYS 454, Intermediate Modern Physics I | | R | 3 | |  | |  |  | F 2016  F 2017 | 13  12 |
| A E 419, Propulsion | | R |  | | 3 | |  |  | F 2016  F 2017 | 35  37 |
| A E 424, Aerospace Systems Engineering | | R |  | | 3 | |  |  | S 2017  S 2018 | 40  38 |
| A E 447, Aerofluidics Laboratory | | R |  | | 3 | |  |  | F 2017  S 2018 | 29  24 |
| General Education Core Elective | | SE |  | |  | | 3 |  | F 2017  S 2018 | n/a  n/a |
| **Year 4, Semester 8 (15 credits)** | |  |  | |  | |  |  |  |  |
| PHYS 455, Intermediate Modern Physics II | | R | 3 | |  | |  |  | S 2017  S 2018 | 13  12 |
| Capstone Design | | R |  | | 3 (√) | |  |  | F 2017  S 2018 | 28  41 |
| Viewing a Wider World Elective | | SE |  | |  | |  | 3 | F 2017  S 2018 | n/a  n/a |
| Viewing a Wider World Elective | | SE |  | |  | |  | 3 | F 2017  S 2018 | n/a  n/a |
| General Education Core Elective | | SE |  | |  | | 3 |  | F 2017  S 2018 | n/a  n/a |
| **TOTALS - ABET BASIC-LEVEL REQUIREMENTS** | | | **39** | | **60** | | **25** | **6** |  | |
| **TOTAL CREDIT HOURS FOR COMPLETION OF THE PROGRAM** | | **130** | |  |  |  | |  |  | |
| **PERCENT OF TOTAL** | | | | **30.0%** | **46.2%** | **19.2%** | | **4.6%** |  | |
| **Total must satisfy either credit hours or percentage** | **Minimum Semester Credit Hours** | | | **32** | **48** |  | |  |  | |
| **Minimum Percentage of Total Credits Required for Graduation** | | | **25%** | **37.5%** |  | |  |  | |

**Table 5.1.b.** Curriculum for Bachelor of Science in Engineering Physics – Chemical Concentration (132-133 credits)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course (Department, Number, Title)**  **List all courses in the program by term starting with first term**  **of first year and ending with the last term of the final year.** | | **Indicate Whether Course is Required, Elective, or a Selective Elective by an R, an E or an SE1** | ***Subject Area (Credit Hours)*** | | | | | | **Last Two Terms the Course was Offered:**  **Year and,**  **Semester, or**  **Quarter** | **Maximum Section Enrollmentfor the Last Two Terms the Course was Offered2** |
| **Math & Basic Sciences** | | **Engineering Topics Check if Contains Significant Design (√)** | | **General Education** | **Other (VWW)** |  |
| **Year 1, Semester 1 (17 credits)** | |  |  | |  | |  |  |  |  |
| MATH 191G, Calculus and Analytic Geometry I | | R | 4 | |  | |  |  | F 2017  S 2018 | 40  40 |
| PHYS 213 (or 215), Mechanics | | R | 3 | |  | |  |  | F 2016  F 2017 | 22  18 |
| PHYS 213L (or 215L), Experimental Mechanics | | R | 1 | |  | |  |  | F 2016  F 2017 | 22  18 |
| ENGR 100, Introduction to Engineering | | R |  | | 3 | |  |  | F 2017  S 2018 | 32  16 |
| CHME 101, Introduction to Chemical Engineering Calculations | | R |  | | 2 | |  |  | --  F 2017 | --  67 |
| CHEM 115, Principles of Chemistry I | | R | 4 | |  | |  |  | F 2016  F 2017 | 62  70 |
| **Year 1, Semester 2 (18 credits)** | |  |  | |  | |  |  |  |  |
| MATH 192G, Calculus and Analytic Geometry II | | R | 4 | |  | |  |  | F 2017  S 2018 | 40  40 |
| PHYS 214 (or 216), Electricity and Magnetism | | R | 3 | |  | |  |  | S 2017  S 2018 | 21  12 |
| PHYS 214L (or 216), Electricity and Magnetism Laboratory | | R | 1 | |  | |  |  | S 2017  S 2018 | 21  12 |
| CHME 102, Materials Balances | | R |  | | 2 | |  |  | S 2017  S 2018 | 38  40 |
| CHEM 116, Principles of Chemistry II | | R | 4 | |  | |  |  | S 2017  S 2018 | 41  53 |
| ENGL 111G, Rhetoric and Composition | | R |  | |  | | 4 |  | F 2017  S 2018 | 27  27 |
| **Year 2, Semester 3 (16 credits)** | |  |  | |  | |  |  |  |  |
| MATH 291G, Calculus and Analytic Geometry III | | R | 3 | |  | |  |  | F 2017  S 2018 | 40  40 |
| PHYS 217, Heat, Light, and Sound | | R | 3 | |  | |  |  | F 2016  F 2017 | 28  29 |
| PHYS 217L, Experimental Heat, Light, and Sound | | R | 1 | |  | |  |  | F 2016  F 2017 | 15  16 |
| CHME 201, Energy Balances & Basic Thermodynamics | | R |  | | 3 | |  |  | F 2016  F 2017 | 36  41 |
| General Education Core Elective | | SE |  | |  | | 3 |  | F 2017  S 2018 | n/a  n/a |
| Written Communication Elective | | SE |  | |  | | 3 |  | F 2017  S 2018 | n/a  n/a |
| **Year 2, Semester 4 (16 credits)** | |  |  | |  | |  |  |  |  |
| MATH 392, Introduction to Ordinary Differential Equations | | R | 3 | |  | |  |  | F 2017  S 2018 | 40  40 |
| PHYS 315, Modern Physics | | R |  | | 3 | |  |  | S 2017  S 2018 | 32  33 |
| PHYS 315L, Experimental Modern Physics | | R |  | | 3 | |  |  | S 2017  S 2018 | 15  16 |
| CHME 301, Chemical Engineering Thermodynamics | | R |  | | 4 | |  |  | S 2017  S 2018 | 30  34 |
| CHME 305, Transport Operations I: Fluid Flow | | R |  | | 3 | |  |  | S 2017  S 2018 | 28  34 |
| **Year 3, Semester 5 (16 credits)** | |  |  | |  | |  |  |  |  |
| PHYS 395, Intermediate Math. Methods of Physics | | R | 3 | |  | |  |  | F 2016  F 2017 | 12  11 |
| PHYS 461, Intermediate Electricity and Magnetism I | | R |  | | 3 | |  |  | F 2016  F 2017 | 17  15 |
| CHME 306, Transport Operations II: Heat & Mass Transfer | | R |  | | 4 | |  |  | F 2016  F 2017 | 28  34 |
| CHEM 313, Organic Chemistry I | | R | 3 | |  | |  |  | F 2017  S 2018 | 117  90 |
| General Education Core Elective | | SE |  | |  | | 3 |  | F 2017  S 2018 | n/a  n/a |
| **Year 3, Semester 6 (16 credits)** | |  |  | |  | |  |  |  |  |
| PHYS 462, Intermediate Electricity and Magnetism II | | R |  | | 3 | |  |  | S 2017  S 2018 | 13  13 |
| CHME 307, Transport Operations III: Staged Operations | | R |  | | 3 | |  |  | S 2017  S 2018 | 26  32 |
| CHME 352L, Simulation of Unit Operations | | R |  | | 1 | |  |  | S 2017  S 2018 | 28  31 |
| CHME 361, Engineering Materials | | R |  | | 3 | |  |  | F 2017  S 2018 | 178  95 |
| CHME 441, Chemical Kinetics and Reactor Engineering | | R |  | | 3 | |  |  | S 2017  S 2018 | 26  32 |
| Oral Communication Elective | | SE |  | |  | | 3 |  | F 2017  S 2018 | n/a  n/a |
| **Year 4, Semester 7 (18 credits)** | |  |  | |  | |  |  |  |  |
| PHYS 454, Intermediate Modern Physics I | | R | 3 | |  | |  |  | F 2016  F 2017 | 13  12 |
| PHYS 451, Intermediate Mechanics | | R | 3 | |  | |  |  | F 2016  F 2017 | 15  17 |
| PHYS 475 (or 471, 493), Advanced Physics Laboratory | | R |  | | 3 | |  |  | S 2017  S 2018 | 8  4 |
| PHYS / CHME, Technical Elective | | E |  | | 3 | |  |  | F 2017  S 2018 | n/a  n/a |
| Viewing a Wider World Elective | | SE |  | |  | |  | 3 | F 2017  S 2018 | n/a  n/a |
| General Education Core Elective | | SE |  | |  | | 3 |  | F 2017  S 2018 | n/a  n/a |
| **Year 4, Semester 8 (15-16 credits)** | |  |  | |  | |  |  |  |  |
| PHYS 455, Intermediate Modern Physics II | | R | 3 | |  | |  |  | S 2017  S 2018 | 13  12 |
| Capstone Design | | R |  | | 3-4 (√) | |  |  | S 2017  S 2018 | 4  4 |
| Viewing a Wider World Elective | | SE |  | |  | |  | 3 | F 2017  S 2018 | n/a  n/a |
| General Education Core Elective | | SE |  | |  | | 3 |  | F 2017  S 2018 | n/a  n/a |
| General Education Core Elective | | SE |  | |  | | 3 |  | F 2017  S 2018 | n/a  n/a |
| **TOTALS - ABET BASIC-LEVEL REQUIREMENTS** | | | **49** | | **52-53** | | **25** | **6** |  | |
| **TOTAL CREDIT HOURS FOR COMPLETION OF THE PROGRAM** | | **132-133** | |  |  |  | |  |  | |
| **PERCENT OF TOTAL** | | | | **37.1%** | **39.5%** | **18.9%** | | **4.5%** |  | |
| **Total must satisfy either credit hours or percentage** | **Minimum Semester Credit Hours** | | | **32** | **48** |  | |  |  | |
| **Minimum Percentage of Total Credits Required for Graduation** | | | **25%** | **37.5%** |  | |  |  | |

**Table 5.1.c.** Curriculum Bachelor of Science in Engineering Physics – Electrical Concentration (130-131 credits)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course (Department, Number, Title)**  **List all courses in the program by term starting with first term**  **of first year and ending with the last term of the final year.** | | **Indicate Whether Course is Required, Elective, or a Selective Elective by an R, an E or an SE1** | ***Subject Area (Credit Hours)*** | | | | | | **Last Two Terms the Course was Offered:**  **Year and,**  **Semester, or**  **Quarter** | **Maximum Section Enrollmentfor the Last Two Terms the Course was Offered2** |
| **Math & Basic Sciences** | | **EngineeringTopics Check if Contains Significant Design (√)** | | **General Education** | **Other (VWW)** |  |
| **Year 1, Semester 1 (15 credits)** | |  |  | |  | |  |  |  |  |
| MATH 191G, Calculus and Analytic Geometry I | | R | 4 | |  | |  |  | F 2017  S 2018 | 40  40 |
| PHYS 213 (or 215), Mechanics | | R | 3 | |  | |  |  | F 2016  F 2017 | 22  18 |
| PHYS 213L (or 215L), Experimental Mechanics | | R | 1 | |  | |  |  | F 2016  F 2017 | 22  18 |
| ENGR 100, Introduction to Engineering | | R |  | | 3 | |  |  | F 2017  S 2018 | 32  16 |
| ENGL 111G, Rhetoric and Composition | | R |  | |  | | 4 |  | F 2017  S 2018 | 27  27 |
| **Year 1, Semester 2 (16 credits)** | |  |  | |  | |  |  |  |  |
| MATH 192G, Calculus and Analytic Geometry II | | R | 4 | |  | |  |  | F 2017  S 2018 | 40  40 |
| PHYS 214 (or 216), Electricity and Magnetism | | R | 3 | |  | |  |  | S 2017  S 2018 | 21  12 |
| PHYS 214L (or 216L), Electricity and Magnetism Laboratory | | R | 1 | |  | |  |  | S 2017  S 2018 | 21  12 |
| E E 100, Introduction to Electrical Engineering | | R |  | | 4 | |  |  | F 2017  S 2018 | 54  33 |
| CHEM 111G (or 115), General Chemistry | | R | 4 | |  | |  |  | F 2017  S 2018 | 142  166 |
| **Year 2, Semester 3 (18 credits)** | |  |  | |  | |  |  |  |  |
| MATH 291G, Calculus and Analytic Geometry III | | R | 3 | |  | |  |  | F 2017  S 2018 | 40  40 |
| PHYS 217, Heat, Light, and Sound | | R | 3 | |  | |  |  | F 2016  F 2017 | 28  29 |
| PHYS 217L, Experimental Heat, Light, and Sound | | R | 1 | |  | |  |  | F 2016  F 2017 | 15  16 |
| E E 112, Embedded Systems | | R |  | | 4 | |  |  | F 2017  S 2018 | 17  33 |
| E E 200, Linear Algebra, Probability & Statistics Applications | | R |  | | 4 | |  |  | F 2017  S 2018 | 36  20 |
| Written Communication Elective | | SE |  | |  | | 3 |  | F 2017  S 2018 | n/a  n/a |
| **Year 2, Semester 4 (16 credits)** | |  |  | |  | |  |  |  |  |
| MATH 392, Introduction to Ordinary Diff. Equations | | R | 3 | |  | |  |  | F 2017  S 2018 | 40  40 |
| PHYS 315, Modern Physics | | R |  | | 3 | |  |  | S 2017  S 2018 | 32  33 |
| PHYS 315L, Experimental Modern Physics | | R |  | | 3 | |  |  | S 2017  S 2018 | 15  16 |
| E E 212, Intro to Computer Architecture and Organization | | R |  | | 4 | |  |  | F 2017  S 2018 | 33  29 |
| Oral Communication Elective | | SE |  | |  | | 3 |  | F 2017  S 2018 | n/a  n/a |
| **Year 3, Semester 5 (16 credits)** | |  |  | |  | |  |  |  |  |
| PHYS 395, Intermediate Math. Methods of Physics | | R | 3 | |  | |  |  | F 2016  F 2017 | 12  11 |
| PHYS 451, Intermediate Mechanics | | R | 3 | |  | |  |  | F 2016  F 2017 | 15  17 |
| PHYS 461, Intermediate Electricity & Magnetism I | | R |  | | 3 | |  |  | F 2016  F 2017 | 17  15 |
| E E 230, AC Circuit Analysis & Introduction to Power Systems | | R |  | | 4 | |  |  | F 2017  S 2018 | 16  36 |
| General Education Core Elective | | SE |  | |  | | 3 |  | F 2017  S 2018 | n/a  n/a |
| **Year 3, Semester 6 (16-17 credits)** | |  |  | |  | |  |  |  |  |
| PHYS 480, Thermodynamics | | R |  | | 3 | |  |  | S 2017  S 2018 | 13  11 |
| PHYS 462 (or E E 351), Intermediate Electricity & Magnetism II | | R |  | | 3-4 | |  |  | S 2017  S 2018 | 13  13 |
| E E 312, Signals and Systems I | | R |  | | 3 | |  |  | F 2017  S 2018 | 28  33 |
| E E 380, Semiconductor Devices and Electronics | | R |  | | 4 | |  |  | F 2017  S 2018 | 33  25 |
| General Education Core Elective | | SE |  | |  | | 3 |  | F 2017  S 2018 | n/a  n/a |
| **Year 4, Semester 7 (18 credits)** | |  |  | |  | |  |  |  |  |
| PHYS 454, Intermediate Modern Physics I | | R | 3 | |  | |  |  | F 2016  F 2017 | 13  12 |
| Capstone Design I | | R |  | | 3 (√) | |  |  | F 2017  S 2018 | 4  4 |
| PHYS / E E, Technical Elective | | E |  | | 3 | |  |  | F 2017  S 2018 | n/a  n/a |
| Viewing a Wider World Elective | | SE |  | |  | |  | 3 | F 2017  S 2018 | n/a  n/a |
| General Education Core Elective | | SE |  | |  | | 3 |  | F 2017  S 2018 | n/a  n/a |
| General Education Core Elective | | SE |  | |  | | 3 |  | F 2017  S 2018 | n/a  n/a |
| **Year 4, Semester 8 (15 credits)** | |  |  | |  | |  |  |  |  |
| PHYS 455, Intermediate Modern Physics II | | R | 3 | |  | |  |  | S 2017  S 2018 | 13  12 |
| PHYS 475 (or 471, 493), Advanced Physics Laboratory | | R |  | | 3 | |  |  | F 2017  S 2018 | 8  4 |
| Capstone Design II | | R |  | | 3 (√) | |  |  | F 2017  S 2018 | 4  4 |
| Viewing a Wider World Elective | | SE |  | |  | |  | 3 | F 2017  S 2018 | n/a  n/a |
| General Education Core Elective | | SE |  | |  | | 3 |  | F 2017  S 2018 | n/a  n/a |
| **TOTALS - ABET BASIC-LEVEL REQUIREMENTS** | | | **42** | | **57-58** | | **25** | **6** |  | |
| **TOTAL CREDIT HOURS FOR COMPLETION OF THE PROGRAM** | | **130-131** | |  |  |  | |  |  | |
| **PERCENT OF TOTAL** | | | | **32.3%** | **43.9%** | **19.2%** | | **4.6%** |  | |
| **Total must satisfy either credit hours or percentage** | **Minimum Semester Credit Hours** | | | **32** | **48** |  | |  |  | |
| **Minimum Percentage of Total Credits Required for Graduation** | | | **25%** | **37.5%** |  | |  |  | |

**Table 5.1.d.** Curriculum for Bachelor of Science in Engineering Physics – Mechanical Concentration (129 credits)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course (Department, Number, Title)**  **List all courses in the program by term starting with first term**  **of first year and ending with the last term of the final year.** | | **Indicate Whether Course is Required, Elective, or a Selective Elective by an R, an E or an SE1** | ***Subject Area (Credit Hours)*** | | | | | | **Last Two Terms the Course was Offered:**  **Year and,**  **Semester, or**  **Quarter** | **Maximum Section Enrollmentfor the Last Two Terms the Course was Offered2** |
| **Math & Basic Sciences** | | **Engineering Topics Check if Contains Significant Design (√)** | | **General Education** | **Other (VWW)** |  |
| **Year 1, Semester 1 (17 credits)** | |  |  | |  | |  |  |  |  |
| MATH 191G, Calculus and Analytic Geometry I | | R | 4 | |  | |  |  | F 2017  S 2018 | 40  40 |
| PHYS 213 (or 215), Mechanics | | R | 3 | |  | |  |  | F 2016  F 2017 | 22  18 |
| PHYS 213L (or 215L), Experimental Mechanics | | R | 1 | |  | |  |  | F 2016  F 2017 | 22  18 |
| ENGR 100, Introduction to Engineering | | R |  | | 3 | |  |  | F 2017  S 2018 | 32  16 |
| M E 159, Graphical Communication and Design | | R |  | | 2 | |  |  | F 2017  S 2018 | 31  47 |
| CHEM 111G, General Chemistry | | R | 4 | |  | |  |  | F 2017  S 2018 | 142  166 |
| **Year 1, Semester 2 (15 credits)** | |  |  | |  | |  |  |  |  |
| MATH 192G, Calculus and Analytic Geometry II | | R | 4 | |  | |  |  | F 2017  S 2018 | 40  40 |
| PHYS 214 (or 216), Electricity and Magnetism | | R | 3 | |  | |  |  | S 2017  S 2018 | 21  12 |
| PHYS 214L (or 216L), Electricity and Magnetism Laboratory | | R | 1 | |  | |  |  | S 2017  S 2018 | 21  12 |
| M E 240, Thermodynamics | | R |  | | 3 | |  |  | F 2017  S 2018 | 46  50 |
| ENGL 111G, Rhetoric and Composition | | R |  | |  | | 4 |  | F 2017  S 2018 | 27  27 |
| **Year 2, Semester 3 (16 credits)** | |  |  | |  | |  |  |  |  |
| MATH 291G, Calculus and Analytic Geometry III | | R | 3 | |  | |  |  | F 2017  S 2018 | 40  40 |
| PHYS 217, Heat, Light, and Sound | | R | 3 | |  | |  |  | F 2016  F 2017 | 28  29 |
| PHYS 217L, Experimental Heat, Light, and Sound | | R | 1 | |  | |  |  | F 2016  F 2017 | 15  16 |
| M E 236, Engineering Mechanics I | | R |  | | 3 | |  |  | F 2017  S 2018 | 48  45 |
| M E 261, Mechanical Engineering Problem Solving | | R |  | | 3 | |  |  | F 2017  S 2018 | 95  95 |
| Written Communication Elective | | SE |  | |  | | 3 |  | F 2017  S 2018 | n/a  n/a |
| **Year 2, Semester 4 (18 credits)** | |  |  | |  | |  |  |  |  |
| MATH 392, Introduction to Ordinary Diff. Equations | | R | 3 | |  | |  |  | F 2017  S 2018 | 40  40 |
| PHYS 315, Modern Physics | | R |  | | 3 | |  |  | S 2017  S 2018 | 32  33 |
| PHYS 315L, Experimental Modern Physics | | R |  | | 3 | |  |  | S 2017  S 2018 | 15  16 |
| M E 237, Engineering Mechanics II | | R |  | | 3 | |  |  | F 2017  S 2018 | 53  43 |
| C E 301, Mechanics of Materials | | R |  | | 3 | |  |  | F 2017  S 2018 | 44  59 |
| Oral Communication Elective | | SE |  | |  | | 3 |  | F 2017  S 2018 | n/a  n/a |
| **Year 3, Semester 5 (15 credits)** | |  |  | |  | |  |  |  |  |
| PHYS 395, Intermediate Math. Methods of Physics | | R | 3 | |  | |  |  | F 2016  F 2017 | 12  11 |
| PHYS 461, Intermediate Electricity and Magnetism I | | R |  | | 3 | |  |  | F 2016  F 2017 | 17  15 |
| M E 326, Mechanical Design | | R |  | | 3 | |  |  | F 2017  S 2018 | 42  50 |
| M E 338, Fluid Mechanics | | R |  | | 3 | |  |  | F 2017  S 2018 | 58  40 |
| General Education Core Elective | | SE |  | |  | | 3 |  | F 2017  S 2018 | n/a  n/a |
| **Year 3, Semester 6 (15 credits)** | |  |  | |  | |  |  |  |  |
| PHYS 462, Intermediate Electricity and Magnetism II | | R |  | | 3 | |  |  | S 2017  S 2018 | 13  13 |
| M E 341, Heat Transfer | | R |  | | 3 | |  |  | F 2017  S 2018 | 45  65 |
| M E 345, Experimental Methods I | | R |  | | 3 | |  |  | F 2017  S 2018 | 55  62 |
| M E 425, Design of Machine Elements | | R |  | | 3 | |  |  | F 2017  S 2018 | 51  38 |
| General Education Core Elective | | SE |  | |  | | 3 |  | F 2017  S 2018 | n/a  n/a |
| **Year 4, Semester 7 (18 credits)** | |  |  | |  | |  |  |  |  |
| PHYS 454, Intermediate Modern Physics I | | R | 3 | |  | |  |  | F 2016  F 2017 | 13  12 |
| PHYS 451 (or M E 333), Intermediate Mechanics | | R | 3 | |  | |  |  | F 2016  F 2017 | 15  17 |
| Capstone Design I | | R |  | | 3 (√) | |  |  | F 2017  S 2018 | 4  4 |
| Viewing a Wider World Elective | | SE |  | |  | |  | 3 | F 2017  S 2018 | n/a  n/a |
| General Education Core Elective | | SE |  | |  | | 3 |  | F 2017  S 2018 | n/a  n/a |
| General Education Core Elective | | SE |  | |  | | 3 |  | F 2017  S 2018 | n/a  n/a |
| **Year 4, Semester 8 (15 credits)** | |  |  | |  | |  |  |  |  |
| PHYS 455, Intermediate Modern Physics II | | R | 3 | |  | |  |  | S 2017  S 2018 | 13  12 |
| Capstone Design II | | R |  | | 3 (√) | |  |  | S 2017  S 2018 | 4  4 |
| PHYS / M E, Technical Elective | | R |  | | 3 | |  |  | F 2017  S 2018 | n/a  n/a |
| Viewing a Wider World Elective | | SE |  | |  | |  | 3 | F 2017  S 2018 | n/a  n/a |
| General Education Core Elective | | SE |  | |  | | 3 |  | F 2017  S 2018 | n/a  n/a |
| **TOTALS - ABET BASIC-LEVEL REQUIREMENTS** | | | **42** | | **56** | | **25** | **6** |  | |
| **TOTAL CREDIT HOURS FOR COMPLETION OF THE PROGRAM** | | **129** | |  |  |  | |  |  | |
| **PERCENT OF TOTAL** | | | | **32.6%** | **43.4%** | **19.4%** | | **4.6%** |  | |
| **Total must satisfy either credit hours or percentage** | **Minimum Semester Credit Hours** | | | **32** | **48** |  | |  |  | |
| **Minimum Percentage of Total Credits Required for Graduation** | | | **25%** | **37.5%** |  | |  |  | |

**Required** courses are required of all students in the program, **elective** courses (often referred to as open or free electives) are optional for students, and **selected elective** courses are those for which students must take one or more courses from a specified group.

For courses that include multiple elements (lecture, laboratory, recitation, etc.), indicate the maximum enrollment in each element. For selected elective courses, indicate the maximum enrollment for each option.

Instructional materials and student work verifying compliance with ABET criteria for the categories indicated above will be required during the campus visit.

*Describe how the curriculum aligns with the program educational objectives.*

The *Program Educational Objectives* of the EP program at NMSU are: (1) competitiveness, (2) adaptability, and (3) teamwork and leadership. These objectives are consistent with and supportive of the institutional educational objectives of the College of Engineering, the College of Arts & Sciences, and New Mexico State University.

**Objective 1: Competitiveness.** The curriculum of the EP program has been specifically designed to enable students to acquire strong fundamental knowledge in physics and the chosen engineering field, adopt effective communication and problem-solving skills, develop the ability to tackle new problems, and achieve a level of preparation that allows continuation to advanced studies after graduation. Each of the four program concentrations requires students to complete at least 34-44 credits of mathematics and basic sciences (including physics), 49-57 credit hours of specialized engineering courses, 33 credits of general education courses, and 6 credits of Viewing the Wider World courses. The strong foundation of fundamental science courses and a broad range of specialized engineering courses help ensure that the EP graduates are competitive in internationally-recognized academic, government and industrial environments.

**Objective 2: Adaptability.** The EP program at NMSU offers a broad selection of courses that cover a variety of engineering and scientific disciplines. The EP program entails more than 50 specialized technical and engineering courses that cover the areas of aerospace, chemical, electrical, and mechanical engineering. The wide selection of specialized courses offered by the program curriculum broadens the range of the potential employment opportunities for EP graduates. These opportunities include employment in research and development, energy and utility, manufacturing, automotive, photonics, aerospace, defense and space, sensor technology, and many other fields.

**Objective 3: Teamwork and Leadership.** As a part of the EP curriculum, students are required to take a sequence of physics and engineering laboratory and capstone courses. In the format of these courses students learn to work in teams, collaborate with other students, and lead a team of students toward successful completion of the project. To complete project requirements successfully, the student must demonstrate practical application of relevant knowledge and skills, such as standard analysis techniques, design principles, as well as teamwork, communication, problem solving, and critical thinking. This approach enables EP graduates to have an ability to function as part of and/or lead interdisciplinary teams.

The *Educational Objectives* of the EP program and the methods of their evaluation are described in more detail in *Criterion 2 – Program Educational Objectives* and *Criterion 4 – Continuous Improvement*.

*Describe how the curriculum and its associated prerequisite structure support the attainment of the student outcomes.*

A list of the physics and engineering courses with the measured program outcomes is shown in the outcome matrix table attached below. To achieve the desired outcomes, a path of core courses (having pre-requisites) has become essential within an integrated, cumulative educational process (see flow charts above). Each course is expected to measure certain *Program Outcomes (a)-(k)*. The assessment matrix for physics courses is given in Table 5.2. Assessment matrices for the engineering courses are given in *Criterion 3 – Program Outcomes* (Tables 3.2.b-e) and the results of course assessments are presented and discussed in *Criterion 4 – Continuous Improvement.*

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Physics Course*** | **Program Outcomes** | | | | | | | | | | |
| ***(a)*** | ***(b)*** | ***(c)*** | ***(d)*** | ***(e)*** | ***(f)*** | ***(g)*** | ***(h)*** | ***(i)*** | ***(j)*** | ***(k)*** |
| PHYS 213 or 215G | **X** |  |  |  |  |  |  |  |  |  |  |
| PHYS 213 or 215L |  | **X** |  |  |  |  |  |  |  |  |  |
| PHYS 214 or 216G | **X** |  |  |  |  |  |  |  |  |  |  |
| PHYS 214 or 216GL |  | **X** |  |  |  |  |  |  |  |  |  |
| PHYS 217 | **X** |  |  |  |  |  |  |  |  |  |  |
| PHYS 217L |  | **X** | **X** | **X** |  |  |  |  |  |  |  |
| PHYS 315 | **X** |  |  |  |  | **X** |  | **X** | **X** | **X** |  |
| PHYS 315L |  | **X** | **a** | **X** |  |  | **X** |  |  |  | **X** |
| PhHYS 395 |  |  |  |  |  | **X** |  |  |  |  |  |
| PHYS 451 |  |  |  |  | **X** |  |  |  |  |  |  |
| PHYS 454 & 455 |  |  |  |  | **X** |  |  |  |  |  |  |
| PHYS 461 & 462 |  |  |  |  | **X** |  |  |  |  |  |  |
| PHYS 471, 475 or 493 |  | **X** | **a** | **X** |  |  | **X** |  |  |  | **X** |
| PHYS 480 |  |  |  |  | **X** |  |  |  |  |  |  |
| Physics Electives |  |  | **a** | **a** |  | **a** |  | **a** | **a** | **a** | **a** |

**Table 5.2:** Assessment Matrix showing the correspondence of Program Outcomes (a) thru (k) to (required and elective) physics courses of the Engineering Physics program. Note, this is the essentially the same table as Table 3.2.a. Unlike this table, Table 3.2.a lists possible physics electives.

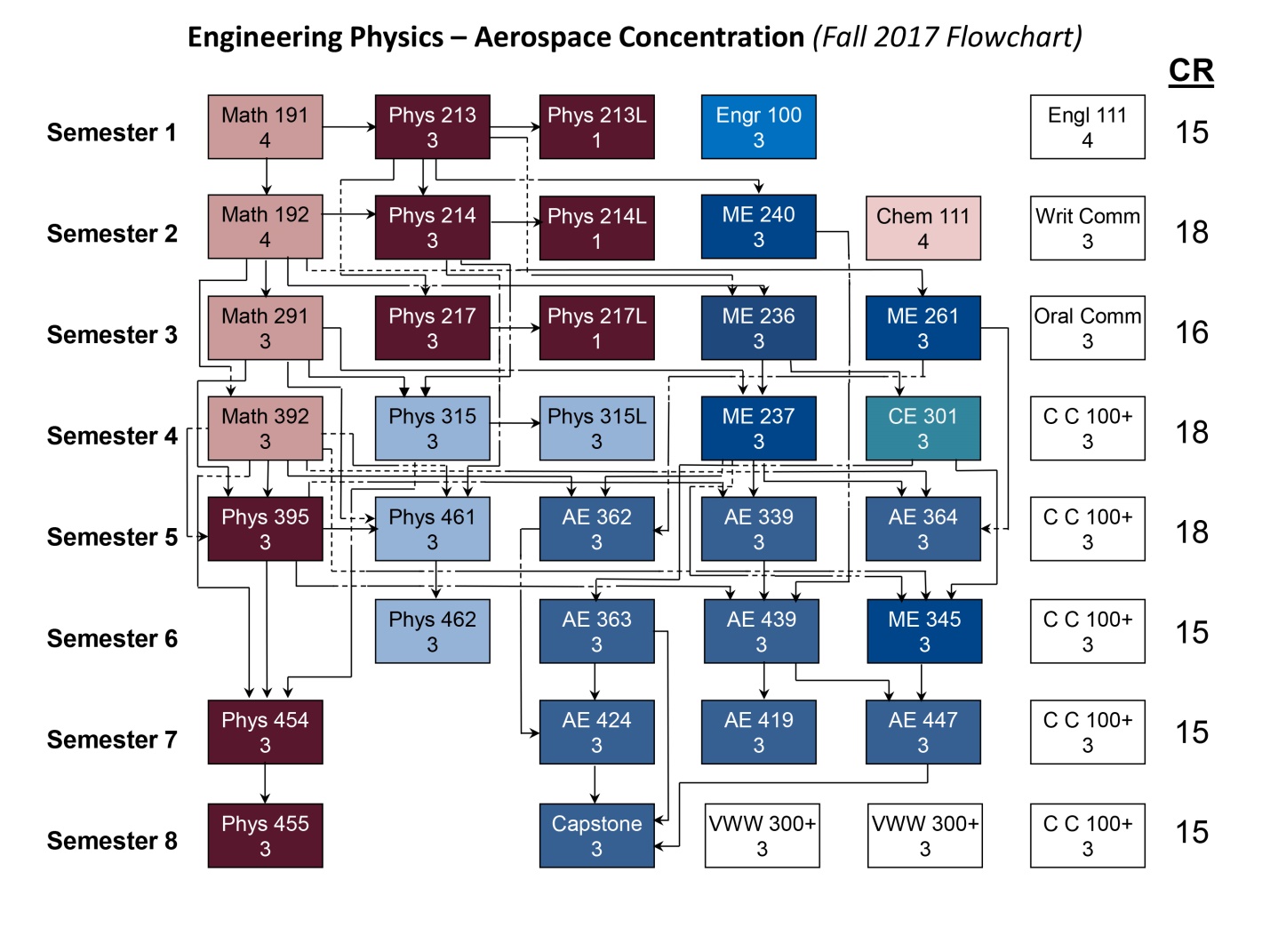
**X:** indicates a measured Program Outcome,

**a:** whether this Program Outcome is measured depends on the individual instructor and/or the course

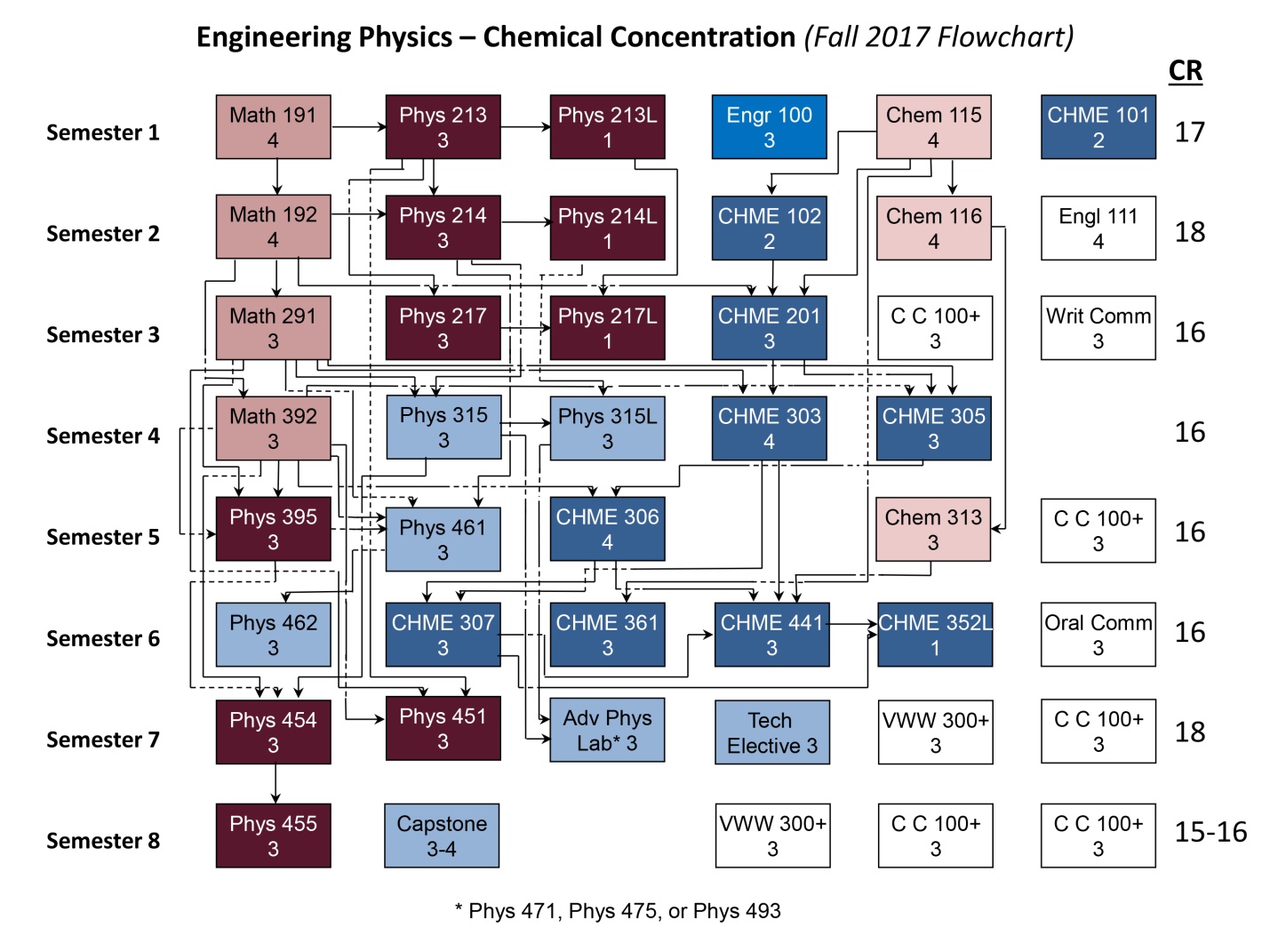
*Attach a flowchart or worksheet that illustrates the prerequisite structure of the program’s required courses.*

Suggested flowcharts for each of the four concentrations (*Aerospace*, *Chemical*, *Electrical* and *Mechanical*) of the EP program are shown in Diagrams 5.1.a-d.

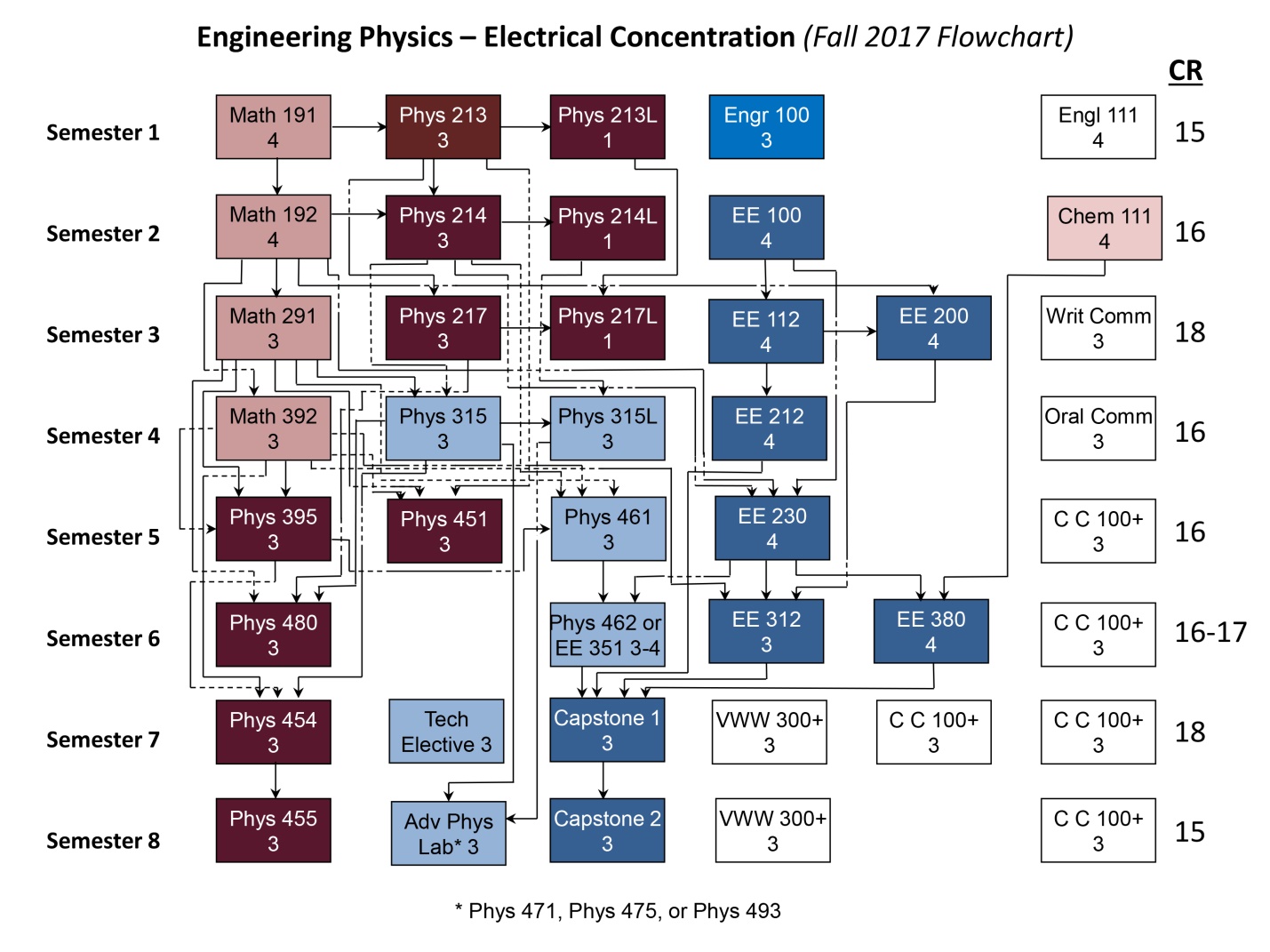
**Diagram 5.1.a.** Proposed Schedule for Engineering Physics with the Aerospace Concentration. Arrows coming in from the top indicate pre-requisite requirements. Arrows from the side indicate co-requisites.



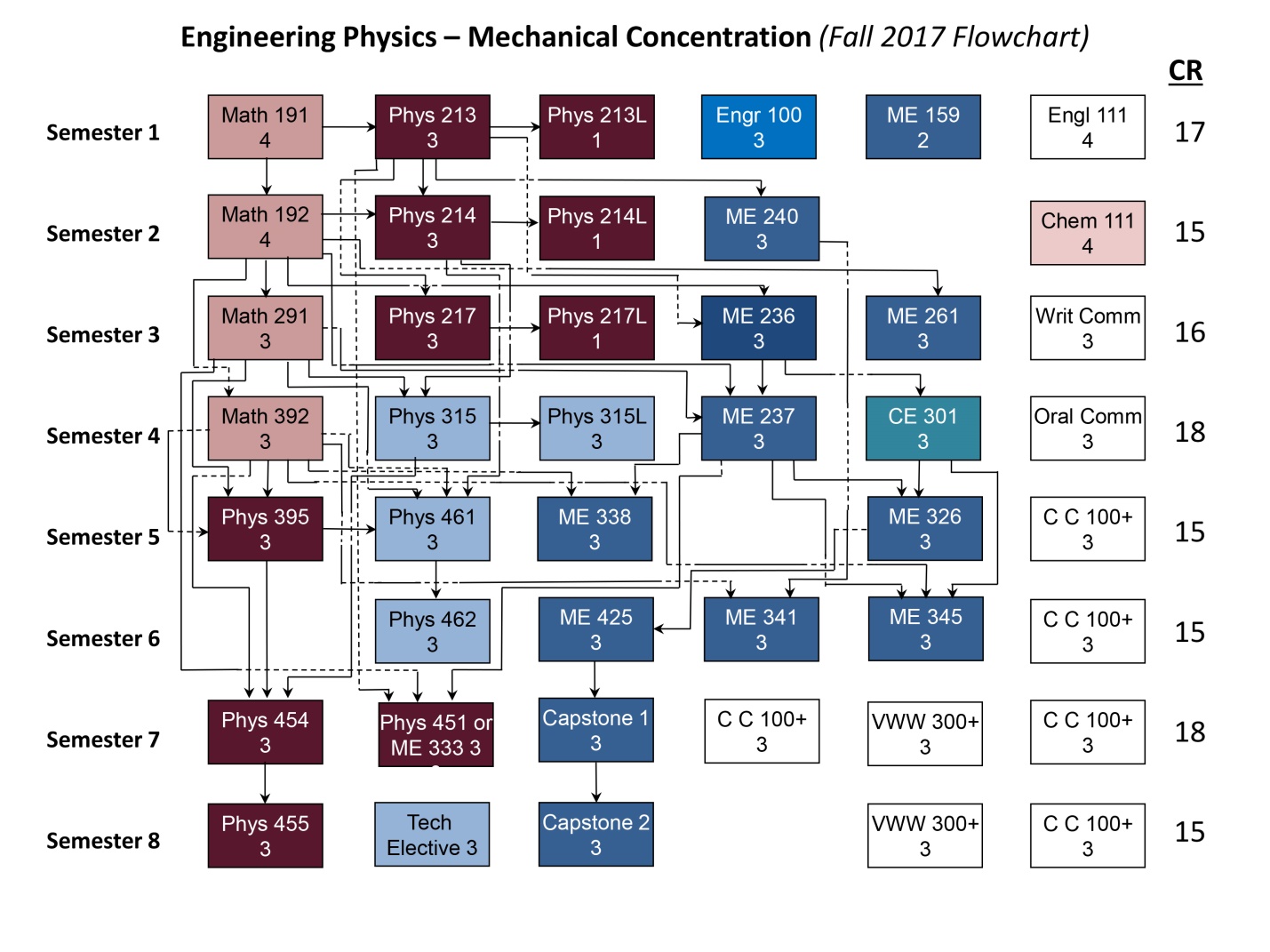
**Diagram 5.1.b.** Proposed Schedule for Engineering Physics with the Chemical Concentration. Arrows coming in from the top indicate pre-requisite requirements. Arrows from the side indicate co-requisites.

****

**Diagram 5.1.c.** Proposed Schedule for Engineering Physics with the Electrical Concentration. Arrows coming in from the top indicate pre-requisite requirements. Arrows from the side indicate co-requisites.



***Diagram 5.1.d.*** *Proposed Schedule for Engineering Physics with the Mechanical Concentration. Arrows coming in from the top indicate pre-requisite requirements. Arrows from the side indicate co-requisites.*



*Describe how the program meets the requirements in terms of hours and depth of study for each subject area (Math and Basic Sciences, Engineering Topics, and General Education) specifically addressed by either the general criteria or the program criteria.*

**Math and Basic Sciences (39-49 credits)**

***Mathematics***

All students enrolled in the EP program at NMSU are required to complete four semesters of mathematics courses, including three semesters of calculus and analytical geometry and one semester of ordinary differential equations. Advanced mathematical methods that are needed for the upper-level physics courses are covered in PHYS 395 and this course is counted toward the physics requirements.

***Physics***

Students enrolled in each of the four EP concentrations are required to complete the core sequence of physics courses offered to the physics majors. The sequence includes 3 introductory level physics courses combined with physics laboratories, 2 intermediate level courses designed to prepare students for the upper division physics classes, and 5-7 advanced physics courses that cover a variety of subjects, including classical mechanics, quantum mechanics, electromagnetic theory, thermodynamics, and advanced physics laboratory. For the individual EP concentrations, the physics sequence is designed to complement, rather than duplicate, the engineering sequence so that students gain a broad physics background.

***Chemistry***

EP students enrolled in the *Aerospace*, *Electrical* and *Mechanical concentrations* are required to complete one semester of general chemistry. EP students with the *Chemical concentration* are required to complete 16 credits of chemistry.

**Specialized Engineering Topics (52-60 credits)**

A broad-based foundation in technical and engineering courses prepares EP graduates for a variety of employment opportunities. The EP program at NMSU offers students a selection of four different concentrations: *Aerospace,* *Chemical*, *Electrical*, and *Mechanical*. All EP students are required to complete the ENGR 100 “Introduction to Engineering” course. In addition to that, students electing the *Mechanical concentration* are required to complete 17 mechanical engineering, civil engineering, laboratory, and capstone design courses. The *Electrical concentration* requires students to complete 16 electrical engineering, laboratory, and capstone design courses. Students enrolled in the *Aerospace concentration* must complete 18 aerospace engineering, mechanical and civil engineering, laboratory, and capstone design courses. The *Chemical concentration* requires students to complete 16 chemical engineering, laboratory, and capstone design courses. The selection of specialized courses is aligned with the *Educational Objectives* of the EP program at NMSU.

**General Education Courses (25 credits)**

***English and Communications***

EP students are required to complete two courses in English (*ENGL 111G* and typically *ENGL 218G*) and one course in Communication (typically: *COMM265G – Technical Writing*).

***General Education Courses in Common Core Areas IV and V***

The general education requirements at NMSU specify that students of all majors select courses that inherently expose them to diversity, and both global and societal issues. These requirements are now part of the New Mexico State Common Core so that these credits can be transferred between institutions. Students are required to take a total of 25 credit hours of humanities and social science electives, as well as complete courses in composition and rhetoric, technical writing, and oral communications.

**Viewing a Wider World Courses (6 credits)**

In addition to general education courses, students are required to complete 6 credits of Viewing a Wider World courses. The Viewing a Wider World program fosters intelligent inquiry, abstract logical thinking, critical analysis, and the integration of knowledge.

*Describe the major design experience that prepares students for engineering practice. Describe how this experience is based upon the knowledge and skills acquired in earlier coursework and incorporates appropriate engineering standards and multiple design constraints.*

Capstone design courses are project-based courses typically centered on a societal or engineering need. This is the students’ opportunity to put their skills to test by addressing *Program Outcomes (h) - Societal Impact* and *(j) - Contemporary Issues*. The capstone design course challenges the student to reflect on prerequisite topics and apply cumulative knowledge that have previously been developed as part of *Program Outcome (a) - Scientific Expertise*, *Program Outcome (e) - Problem Solving*, and *Program Outcome (k) - Technical Know-how*. However, such background itself is not enough, as capstone projects require students to build on their backgrounds through research and development therefore *Program Outcomes (i) - Lifelong learning*, Progr*am Outcome (b) - Experimental Training* and, most importantly, *Program Outcome (c) - Design Abilities.* Moreover, capstone courses require that students work in teams, often with students who have different backgrounds, thus addressing *Program Outcome (d) – Teamwork* and Program Outcome (g) – Communication Skills. The need to work in teams also develops the students’ sense of *Program Outcome (f) - Professional Responsibility*. In other words, capstone design courses expose students (often for the first time) to demands and expectations that they would likely encounter in their future profession.

The College of Arts & Sciences still enforces a 10-student minimum for undergraduate courses, and this poses a problem for a still relatively small program, such as EP where we currently have just ~4-5 seniors, who take the capstones in the same semester. Moreover, this number is further diluted by the fact that our EP students are distributed over the four different concentrations. The low number of EP students does not pose a problem for lecture courses and instructional labs, since these are taken by the physics majors as well. The 10-student minimum is the main reason why most of EP students take capstone design courses in the participating engineering departments, where sufficient enrollment is ensured due to the much larger numbers of their majors. While each engineering capstone consists of 3-5 students, the engineering departments offer all their capstones under one course number, thus easily escaping the 20-student minimum requirement.

The College of Engineering has started exploring the introduction of a college-wide capstone courses that will allow students from different engineering programs (including EP) to participate in joint design projects.

*If the program allows cooperative education to satisfy curricular requirements specifically addressed by either the general or program criteria, describe the academic component of this experience and how it is evaluated by the faculty.*

Cooperative education experience does not currently fulfill any part of the EP curriculum requirements. However, individual faculty members work with both, students and employers, to help facilitate appropriate internship opportunities.

*Describe the materials (course syllabi, textbooks, sample student work, etc.), that will be available for review during the visit to demonstrate achievement related to this criterion. (See the 2018-2019 APPM Section I.E.5.b.(2) regarding display materials.)*

Display materials include two sets of folders for each course taken by EP students as part of the program requirement: the *Instructor Notebooks* and the *Course Notebook*s. The actual contents of such folders are described in greater detail in *Criterion 4 – Continuous Improvement*. The folders will contain general information, instructional material and student work verifying compliance with ABET criteria for the categories indicated above. Textbooks, laboratory manuals and other instructional materials are also available at the time of the review visit.

## B. Course Syllabi

*In Appendix A of the Self-Study Report, include a syllabus for each course used to satisfy the mathematics, science, and discipline-specific requirements required by Criterion 5 or by any applicable program criteria.*

Course syllabi of all required and the most popular elective courses are provided in *Appendix A*.

# CRITERION 6. FACULTY

## A. Faculty Qualifications

Describe the qualifications of the faculty and how they are adequate to cover all the curricular areas of the program and also meet any applicable program criteria. This description should include the composition, size, credentials, and experience of the faculty. Complete Table 6-1. Include faculty resumes in Appendix B.

The *Engineering Physics (EP) Program* in the NMSU *College of Engineering* is offered jointly by the *Department of Physics* in the *College of Arts & Sciences* and the *Departments of Mechanical & Aerospace Engineering (MAE), Electrical & Computer Engineering (ECE),* and *Chemical & Materials Engineering (ChME)* in the *College of Engineering*. Specialty courses in engineering are typically taught by the respective *ABET*-accredited departments in the College of Engineering. On rare occasions, physics faculty will teach cross-listed courses, particularly between EE or ChME and physics. The *Department of Physics* provides a strong fundamental physics education in support of these disciplines and overall program management.

The instructional faculty members and staff of the *Departments of Physics* and the participating *Engineering Departments* are summarized in Table 6-1.a-d. The combination of Physics and Engineering faculty is well qualified to cover all the curricular areas of the E) program.

As of May 2017, the Physics faculty consists of the following:

* thirteen tenure-track and tenured faculty members (13 full-time equivalent lines),
* two college faculty members with teaching responsibilities (1.0 full-time equivalent).
* one professional staff member with responsibility for instructional support and involvement in instructional laboratory development,
* several graduate teaching assistants with outstanding teaching skills, who are assigned as instructors of record for introductory physics courses or instructional laboratories, usually under close supervision of the department head or another faculty member.

All faculty members, who teach courses needed for the EP program, have Doctorate degrees in Physics, other Sciences, or Engineering. The professional support staff member has an M.S. degree in Physics and a BS degree in EP. Only truly outstanding graduate assistants (top 10%) are assigned as lecturers for introductory physics courses or as instructors of record for the instructional laboratories. Some of them have been mentored with a “Preparing Future Faculty” fellowship by the *NMSU Graduate College* or participated in teaching workshops organized by the *NMSU Teaching Academy*. Following new guidelines to determine the qualifications of faculty established by the *Higher Learning Commission (HLC)* (formerly *North-Central Association of Colleges and Schools*), NMSU implemented *Administrative Rule and Procedure (ARP) 6.50* to verify that all faculty have credentials in the discipline they teach consistent with these *HLC* guidelines. Resumes of all faculty members, staff and graduate students who have been involved in teaching duties are provided in Appendix B. The faculty, teaching assistants, and staff are well qualified to teach the required curriculum.

Two of the physics faculty members (Drs Matthias Burkardt and Stefan Zollner) are *Fellows of the American Physical Society (APS).* Dr. Zollner is also a *Fellow of the American Vacuum Society (AVS).* Dr. Zollner has served a four-year term in the *FIAP (Forum of Industrial and Applied Physics of the APS)* Chair-line, a four-year term as *FIAP Councilor*, a four-year term on the *APS Council*, a two-year term on the *APS Executive Board*, and on many APS committees. Dr. De Antonio has served in the Chair line of the *Physics Committee of the American Society for Engineering Education (ASEE)*. He was also the Conference General Chair of the *Frontiers in Education 2015 Conference* held in El Paso, TX, about 50 miles from the NMSU main campus. Dr. Nakotte has served a four-year term as a member of the Executive Committee of the *Four Corners Section of the APS*. Samantha Sword-Fehlberg currently serves as the student member of the *Executive Committee of the Four Corners Section of the APS*. Dr. Zollner also serves a two-year term on the executive committees of *the New Mexico Chapter of the American Vacuum Society (AVS)*. Dr. Matthias Burkardt recently (2015) completed a four-year term in the Chair-line of the *Topical Group on Hadronic Physics in the APS*. Dr. Zollner serves as a member of the board of the *New Mexico Consortium (NMC)*, a non-profit established by the three New Mexico research universities and *Los Alamos National Laboratory* to link these institutions through research and education. Other accomplishments of faculty are listed in the Appendix B.

## B. Faculty Workload

*Complete Table 6-2, Faculty Workload Summary and describe this information in terms of workload expectations or requirements.*

Faculty workloads are presented in Table 6.2.a-d, which lists all faculty members (and some staff and students) who have a vested interest and/or taught courses related to the EP program in the Departments of *Physics, Mechanical & Aerospace Engineering, Electrical & Computer Engineering,* and *Chemical & Materials Engineering*, respectively.

As can be seen in Table 6.2.a, the teaching loads in the *Department of Physics* are relatively low. In the *College of Arts & Sciences*, the nominal teaching load for tenured and tenure-track faculty of a PhD-granting department (such as Physics) is three formal courses (9 credit hours) per year, which is considered to be a 37.5% teaching load. In addition, regular faculty members are expected to carry out active externally funded research programs, support and supervise undergraduate and graduate student research, and perform service. At the discretion of the Department Head and with approval of the *Dean of Arts & Sciences*, teaching loads are increased for faculty members, who are less active in research or supervise fewer graduate students. All regular (tenured) faculty members have active research programs, most of them externally supported by government or industrial agencies. Some faculty further reduce their teaching load by using grant funds to “buy out” academic year teaching and spend more time on research. Several physics faculty members (Fohtung, Cooper, Schlegel, Waszek) have bridged appointments with research institutions (*Los Alamos National Lab, Department of Energy, Brookhaven National Lab, Australian National University)* which pay 50% of the faculty members academic salary, in lieu of a 50% reduction in teaching responsibilities. Faculty workloads are also modified during sabbatical leave. The strong funded research component allows the department to offer well supported undergraduate and graduate research opportunities. Unlike Physics, there is no similar (fairly) uniform percent allocation in the engineering departments (*College of Engineering*), and the distribution of effort is typically left to the individual departments and their heads.

Faculty members are evaluated annually for their performance in the areas of teaching, research, outreach, and service as specified by the *College of Arts & Sciences* and NMSU policy and procedures. The evaluation is performed by a committee consisting of two tenured faculty members elected by the faculty and the Department Head. This evaluation is used as the primary basis for awarding merit-based salary increases and for determining future teaching loads, and it is considered in the promotion and tenure process. Criteria for teaching may include student and peer evaluations, direct measures of learning, mentoring of graduate students, and extra effort preparing course or instructional laboratory materials. Participation in the *ABET* assessment process is also considered. (In rare cases, faculty members who do not offer evidence of teaching effects or other documents required for the *ABET* assessment process receive a rating of “Does Not Meet Expectations” for teaching.) Research is evaluated on the basis of number and quality of publications, conference presentations, proposals submitted and funded, and support of students. Service can include professional service, such as refereeing publications or proposals, organization of conferences, service on university committees, and community service. Major prizes won in any of these areas also influence the rating. In addition to the annual evaluations faculty are also evaluated every 3 to 5 years by the *Graduate School* for membership on the graduate faculty. The primary criteria are a) creative activity; b) continual study in their field; and c) successful teaching.

## C. Faculty Size

*Discuss the adequacy of the size of the faculty and describe the extent and quality of faculty involvement in interactions with students, student advising and counseling, university service activities, professional development, and interactions with industrial and professional practitioners including employers of students.*

The size of the physics faculty is adequate to teach all courses required for the EP curriculum at least once per year. First-year introductory physics courses are taught in both fall and spring semesters and also during the summer. Like many science departments, the *Department of Physics* has lost several faculty members over the last 20 years. We have responded to this loss of faculty lines by reducing the frequency of physics electives. To increase elective opportunities for students, some courses are taught jointly between physics and engineering, for example *Introduction to Nanotechnology* (with *Chemical & Materials Engineering*), *Optics* (with *Electrical & Computer Engineering*), and *Modern Materials or Intermediate X-ray Diffraction* (taught by Physics).

Exit interviews usually show that students are very satisfied with the quality of advising they receive. All EP students meet with a faculty advisor at least once every semester (usually a week before course registration starts for the following semester). The advising responsibility is presently been shared by three *Engineering Physics Advisors* (Drs Heinz Nakotte, Tom Hearn, and Stephen Pate).

Four faculty members (Drs Boris Kiefer, Lauren Waszek, Michael De Antonio, Heinz Nakotte) engage with students through the *Society of Physics Students (SPS)* and the *Society for Engineering Physics (S/EPh) students*. These societies meet weekly (sometimes jointly) to review important skills (opportunities for jobs and internships, resume writing, applying for graduate school, taking standardized test), usually in the evening. In many instances, the department pays for pizza at such events to encourage student attendance. We also have society meetings (moderated by faculty) where students report on their undergraduate research or capstone projects.

The most significant challenge related to faculty is the following: Due to space limitations in Gardiner Hall, very limited start-up funds for new faculty, and limited cash cost-share contributions for equipment proposals, few faculty members (Drs Stefan Zollner, Jacob Urquidi, Robert Cooper, and Edwin Fohtung) have on-campus physics research laboratories suitable for capstone projects and undergraduate research. Therefore, most EP students fulfill their capstone requirement utilizing research facilities that are available in the engineering departments. Moreover, a substantial fraction of physics faculty members perform theoretical research or experimental off-campus research (especially at national laboratories, such as *Los Alamos, Brookhaven,* or *Fermi National Accelerator Lab*). Therefore, the shortage of experimental facilities in the Department of Physics limits employment opportunities for students as undergraduate research aides or for undergraduate research and capstone projects.

## D. Professional Development

Provide detailed descriptions of professional development activities for each faculty member.

All tenured faculty members are eligible for sabbaticals as described in NMSU Administrative Rule and Procedure 8.54. “*The purpose of a sabbatical leave is to promote professional growth*.” After at least 12 semesters of full-time service, faculty members apply for a sabbatical during the spring semester, requiring approval from the *Head of the Department of Physics*, the *Dean of Arts & Sciences*, and the *Executive Vice President and Provost*. Sabbatical leaves are for one semester at no reduction in salary or for a year at 60% of salary. The other 40% of salary plus travel expenses are often covered, at least in part, by a host institution visited by the faculty member on sabbatical, such as *Los Alamos National Laboratory, Fermilab, Air Force Research Lab, University of New Mexico,* or *Jefferson Laboratory* in recent history. Sabbatical leave is also available to the Department Head.

The *Department of Physics* has a vibrant weekly colloquium speaker series. Typically, about two thirds of colloquium speakers are external. In addition to giving a colloquium about their research, the colloquium speakers also meet individually with faculty and students throughout the day to exchange ideas about topics of common interest (teaching, research, service). Both, the colloquium and the individual meetings, contribute to faculty development. Many colloquia are held jointly with other academic departments.

Most tenured and tenure-track physics faculty members (all except two) have significant external research grants (in excess of typically 100 k$ per year per faculty member). Their research grants typically contain funds for travel to conferences or other institutions, and almost all faculty members regularly attend meetings and conferences, since this is an expectation listed in the *Functions and Criteria* document of the department. Although the primary purpose of conference attendance is often dissemination of research results and exchange of knowledge, many conferences such as the March or April meetings of the *American Physical Society* usually also have sessions contributing to professional development in physics education. Most of our faculty members tend to attend such sessions.

The *Department of Physics* (from its operational I&G funds) and the *College of Arts & Sciences* provide travel support for College Faculty to attend a regional or national meeting on Physics Education (such as the annual meeting of the *American Society of Engineering Education* or the *American Association of Physics Teachers*). Sometimes, such attendance is also supported by the conference organizers, often through travel grants earmarked for minority-serving institutions. The Department Head and other departmental leaders (undergraduate program heads) attend physics leadership conferences, such as the biennial physics department chair conference (organized by *APS* and *AAPT*) and meetings intended to increase *STEM* education and enrollment, development of peer learning assistants, or physics teacher education. Learning obtained at such conferences and workshops is shared with relevant physics faculty members.

The physics faculty meets at least once or twice per month to discuss (and decide, if appropriate) departmental business. There are also special faculty meetings dedicated to continuous improvement of our undergraduate physics programs. Some of these meetings involve faculty from the participating engineering departments. The *Engineering Physics External Advisory Board (EPEAB)* and the *Physics External Advisory Board* (two separate entities, which meet annually) also provide valuable information, advice, and recommendations to the physics faculty, both in their reports and also in meetings with individual faculty or with groups of faculty. Finally, development opportunities for faculty are offered by the *NMSU Teaching Academy*. Topics of their courses include engagement of students through active teaching methods, on-line instruction, learning management systems, serving specific demographic groups like veterans, minorities, or students with disabilities, and institutional promotion and tenure procedures. The Dean and Department Head remind faculty about important policies, such as Title IX, accommodation of students with disabilities, or measuring effective teaching.

While NMSU is a minority-serving institution with very limited funds for professional development, there are nevertheless ample opportunities to achieve this aim. Typically, all physics faculty members travel at least once per year, many of them more often. Therefore, institutional support for faculty development appears adequate.

## E. Authority and Responsibility of Faculty

*Describe the role played by the faculty with respect to course creation, modification, and evaluation, their role in the definition and revision of program educational objectives and student outcomes, and their role in the attainment of the student outcomes. Describe the roles of others on campus, e.g., dean or provost, with respect to these areas.*

As shown in Table 6.2.a, all physics faculty contribute to the guidance and execution of the EP program, although some contribute a greater portion of their effort than others. It should be noted that neither the physics nor the engineering departments offer any course dedicated to EP students only. There are two reasons for that: a) the number of EP students is too low (39 students in Fall 2017) in order to ensure the minimum enrollment of 10 students required for any undergraduate course, and b) none of the departments has the personnel strength to teach additional courses. In Table 6.2, we list only the physics and engineering courses, which have been (or could have been) taken by EP students in order to fulfill course requirements or electives. Generally, the majority of students enrolled in those courses were other engineering or physical science (including physics) majors.

Because of that, it is also not necessarily straightforward to provide a realistic estimate of the actual time devoted to the EP program by individual faculty members from the different departments. We used the following scheme to come up with some rough estimates:

NMSU considers eight 3-credit courses per semester as a full load. i.e. each course counts for 12.5% of time commitment. Given that undergraduate enrollments of physics and EP majors are fairly similar, we can estimate that teaching three relevant undergraduate courses per year (1.5 per semester) therefore translates to 18.75% of time commitment due to *actual teaching in the EP program*. For any of the physics courses, the faculty member was given full credit as he/she is expected to fully comply with all EP assessment requirements, regardless whether there were several or no EP students enrolled in the course. For any engineering course, the faculty member received only half of the credit since none of those courses has any EP-specific assessment requirements.

Some differences between *actual teaching in the EP program* and *percentage teaching assignment* (column 4 in Table 6.2) are due to teaching of non-relevant courses (e.g. physics for non-science majors, graduate courses); however, some of it can be attributed to course curriculum development and/or advising. Curriculum changes are proposed by the *EP Program Committee*, reviewed by the *Physics Department Curriculum Committee*, and then approved by the entire physics faculty in a faculty meeting. Therefore, all physics faculty members are involved in course/curriculum development for the EP program, and we estimated the commitment as 2.5% (for non-members of the *Curriculum Committee*), 5% (for members) and 7.5% (for the *Curriculum Committee Chair*, Dr. Igor Vasiliev).

The time commitment of faculty members involved in advising of EP students was estimated at 5%.

Time commitments for serving on the *EP Program Committee* were estimated at 5% for committee members (including *ex officio*) and 10% for the *Chair of the Committee* Dr. (Heinz Nakotte).

Faculty members who worked with EP students on research or educational projects in the past year received another 5%.

The resulting percentages of time devoted were then rounded to next integer. It has to be pointed out that some of the contributions are not solely dedicated to EP alone (i.e. the contributions computed from teaching).

The percentage of time devoted to the EP program is listed in the last column in Table 6.2. It does not include advising of graduate student research, teaching of graduate courses, and teaching of algebra-based or conceptual physics courses. A faculty member on sabbatical will also, by definition, contribute very little to the EP program.

All faculty contribute to the assessment of *ABET Program Outcomes*. Each instructor completes a *Post Course Instructor Comment Form* after each semester. The faculty members also report on their teaching effectiveness (including evidence of student learning and/or evidence from other professionals) in their annual performance reports on the *NMSU Digital Mea*sures web site. Every faculty member is responsible for analyzing assessment data for one outcome and he or she reviews all relevant post-instruction forms for this outcome. There is an annual assessment faculty meeting, where the faculty report on their outcomes and discuss solutions to address findings and improve the program. This ensures that all faculty members have a stake in the EP program and contribute to continuous improvement. All faculty members are expected to meet with the EP advisory board members during a pizza lunch at the annual board meeting. (Unexcused absences are considered non-collegial and addressed by the Department Head in the annual performance appraisals.) Many faculty members contributed to the writing of the *ABET* self-study. In particular, assessment of individual program outcomes and compilation of different criteria for this *Self-Study Report* were assigned to different faculty members.

The Physics Department Head documents contributions to continuous improvement of the physics degree programs in his annual performance appraisal of the faculty members. Usually, almost all faculty members meet expectations with their contributions to the program. The Associate Deans for Academics in both colleges work with the Physics Department Head to encourage compliance with institutional and ABET assessment deliverables by all faculty members. For example, faculty members who do not properly document their teaching effectiveness in the *NMSU Digital Measures* web site receive a performance rating of “Does not meet expectations” for their teaching contributions. The institutional expectations for documentation of teaching effectiveness for individual faculty and for the overall assessment of academic programs are very similar to the *ABET* expectations. Annual assessment reports for the undergraduate and graduate physics programs are entered into an online database (*WEA VE*) and reviewed by the *Office of Assessment*, which reports to the Deputy Provost. This office provides feedback to the department about the effectiveness of its assessment efforts.

The *Dean of Arts & Sciences* and the *Associate Dean of Academics in the College of Engineering* meet with the *EPEAB* during their meetings. (This is common for all annual board meetings.) Deans and Associate Deans in both colleges also review the report of the *EPEAB* and discuss implementation of recommendations with the Physics Department Head. For example, the *Dean of Arts & Sciences* recently established college-wide professional development grants for faculty and staff and travel grants for students. Both colleges revised and expanded the student ambassador program to recruit and retain students and to enhance the participation of students in academic programs.

**Table 6-1.a.** Faculty Qualifications – Department of Physics, Bachelor of Science in Engineering Physics

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Faculty Name** | **Highest Degree Earned- Field and Year** | **Rank 1** | **Type of Academic Appointment2**  **T, TT, NTT** | **FT or PT3** | **Years of Experience** | | | **Professional Registration/ Certification** | **Level of Activity4**  **H, M, or L** | | |
| **Govt./Ind. Practice** | **Teaching** | **This Institution** | **Professional Organizations** | **Professional Development** | **Consulting/summer work in industry** |
| Matthias Burkardt | Ph.D. Physics 1989 | P | T | FT | 2 | 21 | 23 | NA | M | H | L |
| Michaela Burkardt | Ph.D. Physics 1992 | P | NTT | PT | 2 | 16 | 16 | NA | L | M | L |
| Robert Cooper | Ph.D. Physics 2008 | AST | TT | FT | 2 | 3 | 3 | NA | M | H | L |
| Michael  De Antonio | Ph.D. Physics 1993 | P | NTT | PT | 15 | 17 | 16 | NA | H | H | H |
| Michael Engelhardt | Ph.D. Physics 1994 | P | T | FT | 5 | 13 | 14 | NA | M | H | L |
| Edwin Fohtung | Ph.D. Physics 2010 | AST | TT | FT | 8 | 5 | 5 | NA | M | H | L |
| Thomas Hearn | Ph.D. Geophysics 1985 | ASC | T | FT | 1 | 17 | 18 | NA | L | H | L |
| Boris Kiefer | Ph.D. Mineral Physics 2002 | P | T | FT | 0 | 15 | 15 | NA | L | H | M |
| Heinz Nakotte | Ph.D. Physics 1994 | P | T | FT | 24 | 19 | 21 | NA | M | H | L |
| Vassilios Papavassiliou | Ph.D. 1988 | ASC | T | FT | 5 | 22 | 23 | NA | L | H | L |
| Stephen Pate | Ph.D. Physics 1987 | P | T | FT | 0 | 23 | 23 | NA | L | H | L |
| Marc Schlegel | Ph.D. Physics 2006 | AST | TT | FT |  |  |  | NA | L | H | L |
| Jacob Urquidi | Ph.D. Physical Chemistry 2001 | ASC | T | FT |  |  |  | NA | L | L | L |
| Igor Vasiliev | Ph.D. Materials Science 2000 | P | T | FT | 2 | 15 | 16 | NA | L | H | L |
| Lauren Waszek | Ph.D. Earth Sciences 2012 | AST | TT | FT | 0 | 2 | 2 | NA | L | H | L |
| Stefan Zollner | Ph.D. Physics 1991 | P | T | FT | 14 | 13 | 8 | NA | H | H | H |
| Farzin Abadizaman | MS Physics 2012 | O | NTT | PT | 0 | 2 | 2 | NA | L | M | L |
| Fatma Aslan | MS Physics 2009 | O | NTT | PT | 0 | 3 | 3 | NA | L | H | L |
| Federico Alvarez | MS Industrial Engineering 2013 | O | NTT | PT | 1 | 5 | 1 | NA | L | L | L |
| Galen Helms | BS Engineering Physics 2015 | O | NTT | PT | 6 | 1 | 1 | NA | L | L | M |
| Gregg McPherson | MS Physics 2014 | O | NTT | PT | 0 | 2 | 2 | NA | L | M | L |
| Nalin Fernando | Ph.D. Physics 2017 | O | NTT | PT | 1 | 2 | 2 | NA | L | H | L |
| Timothy N. Nunley | MS Physics 2016 | O | NTT | PT | 0 | 1 | 1 | NA | L | M | L |
| Hasan Sezer | MS Physics 2011 | O | NTT | PT | 0 | 1 | 1 | NA | L | M | L |
| Nuwanjula Samarasingha | MS Physics 2018 | O | NTT | PT | 0 | 2 | 2 | NA | M | M | L |
| Samantha Sword-Fehlberg | BS Physics 2016 | O | NTT | PT | 1 | 1 | 1 | NA | M | M | L |
| Francisco Carreto-Parra | MS Physics 2007 | O | NTT | FT | 4 | 10 | 1 | NA | M | M | M |

1. Code: P = Professor ASC = Associate Professor AST = Assistant Professor I = Instructor A = Adjunct O = Other

2. Code: T = Tenured TT = Tenure Track NTT = Non Tenure Track

3. Code: FT = Full-time PT = Part-time Appointment at the institution.

4. The level of activity (high, medium or low) should reflect an average over the year prior to the visit plus the two previous years.

**Table 6-1.b.** Faculty Qualifications – Department of Mechanical & Aerospace Engineering

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Faculty Name** | **Highest Degree Earned- Field and Year** | **Rank 1** | **Type of Academic Appointment2**  **T, TT, NTT** | **FT or PT3** | **Years of Experience** | | | **Professional Registration/ Certification** | **Level of Activity4**  **H, M, or L** | | |
| **Govt./Ind. Practice** | **Teaching** | **This Institution** | **Professional Organizations** | **Professional Development** | **Consulting/summer work in industry** |
| Abdelkefi, Abdessattar | Ph.D. Engineering Mechanics, 2012 | AST | TT | FT | 0 | 4 | 4 | None | M | M | L |
| Chaitanya, Vimal | Ph.D. Materials Sci. & Eng, 1984 | P | T | FT | 4 | 33 | 11 | None | H | M | L |
| Chen, Ruey-Hung | PhD. Aerospace Engineering, 1988 | P | T | FT | 3 | 26 | 3 | None | M | L | L |
| Choo, Vincent | Ph.D. Composite Materials, 1982 | ASC | T | FT | 0 | 32 | 32 | None | L | L | L |
| Conley, Edgar | Ph.D. Engineering Mechanics, 1986 | ASC | T | FT | 1 | 32 | 30 | PE (MI) | M | L | L |
| Drach, Borys | Ph.D. Mechanical Engineering, 2013 | AST | TT | FT | 0 | 5 | 5 | None | M | L | L |
| Garcia, Gabriel | Ph.D. Mechanical Engineering, 1996 | ASC | T | FT | 0 | 22 | 22 | None | L | L | L |
| Gross, Andreas | Dr. (German) Mechanical Engineering, 2002 | AST | TT | FT | 0 | 8.5 | 4.5 | None | M | L | L |
| Kota, Krishna | Ph.D. Mechanical Engineering, 2008 | AST | TT | FT | 2 | 5 | 5 | None | M | L | L |
| Kuravi, Sarada | Ph.D. Mechanical Engineering, 2009 | AST | TT | FT | 0 | 5 | 3 | None | M | L | L |
| Lee, Young Sup | Ph.D. Mechanical Engineering, 2006 | ASC | T | FT | 0 | 12 | 10 | None | M | M | M |
| Park, Hyeongjun | Ph.D. Aerospace Engineering, 2014 | AST | TT | FT | 0 | 0 | 0 | None | M | M | L |
| Park, Young Ho | PhD. Mechanical Engineering, 1994 | ASC | T | FT | 2 | 17 | 17 | None | M | M | L |
| Sevostianov, Igor | Ph.D. Solid Mechanics, 1993 | P | T | FT | 0 | 24 | 16 | None | M | L | H |
| Shashikanth, Banavara | Ph.D. Aerospace Engineering, 1998 | ASC | T | FT | 2 | 18 | 18 | None | L | M |  |
| Shu, Fangjun | Ph.D. Mechanical Engineering, 2005 | ASC | T | FT | 0 | 7 | 7 | None | L | L |  |
| Liang Sun | Ph.D. Electrical and Computer Engineering, 2012 | AST | TT | FT |  | 5 | 2 | None | H | H |  |

1. Code: P = Professor ASC = Associate Professor AST = Assistant Professor I = Instructor A = Adjunct O = Other

2. Code: T = Tenured TT = Tenure Track NTT = Non Tenure Track

3. Code: FT = Full-time PT = Part-time Appointment at the institution.

4. The level of activity (high, medium or low) should reflect an average over the year prior to the visit plus the two previous years.

**Table 6-1.c.** Faculty Qualifications – Department of Electrical & Computer Engineering

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Faculty Name | Highest Degree Earned | Rank 1 | Type of Appointment 2 | Full or Part Time | Years of Experience | | | Professional Registration | Level of Activity | | |
| Govt./Ind. | Total Teaching | This Institution | Professional Organizations | Professional Development | Consulting/  Summer industry |
| Borah, Deva | PhD, 2000 | ASC | T | FT | 0 | 19 | 12 | None | Medium | High | None |
| Boehmer, Charles | MS, 1973 | A | NTT | PT | 39 | 12 | 12 | None | None | None | None |
| Boucheron, Laura | PhD, 2008 | AST | TT | FT | 2 | 1 | 1 | None | Low | High | None |
| Brahma, Sukumar | PhD, 2001 | AST | TT | FT | 2 | 9 | 5 | None | High | High | Medium |
| Cho, Sang-Yeon | PhD, 2003 | AST | T | FT | 0 | 5 | 5 | None | Medium | High | None |
| Cook, Jeanine | PhD, 2002 | ASC | TT | FT | 7 | 9 | 9 | None | Medium | High | None |
| Creusere, Charles | PhD, 1993 | P | T | FT | 10 | 11 | 11 | None | High | High | Low |
| Dawood, Muhammed | PhD, 2001 | ASC | T | FT | 6 | 14 | 7 | None | Low | Medium | None |
| DeLeon, Phillip | PhD, 1995 | P | T | FT | 0 | 16 | 16 | None | Low | Medium | Medium |
| Furth, Paul | PhD, 1996 | ASC | T | FT | 5 | 17 | 17 | None | Low | Low | Low |
| Huang, Hong | PhD, 2002 | ASC | T | FT | 11 | 11 | 9 | None | Medium | Medium | Low |
| Kliewer, Joerg | PhD, 1999 | AST | TT | FT | 0 | 13 | 5 | None | High | High | None |
| Liu, Wenxin | PhD, 2005 | AST | TT | FT | 3 | 3 | 3 | None | Low | High | None |
| Ng, Kwong | PhD, 1985 | P | T | FT | 0 | 27 | 21 | None | Low | High | Low |
| Oklobdzija,Vojin | PhD, 1982 | P | T | FT | 6 | 22 | 1 | None | High | High | High |
| Paz, Robert | PhD, 1991 | ASC | T | FT | 2 | 21 | 21 | None | Low | Medium | None |

1. Code: P = Professor ASC = Associate Professor AST = Assistant Professor A = Adjunct

2. Code: TT = Tenure Track T = Tenured NTT = Non Tenure Track

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Faculty Name | Highest Degree Earned | Rank 1 | Type of Appointment 2 | Full or Part Time | Years of Experience | | | Professional Registration | Level of Activity | | |
| Govt./Ind. | Total Teaching | This Institution | Professional Organizations | Professional Development | Consulting/  Summer industry |
| Petersen, Krist | PhD, 1997 | ASC | NTT | FT | 2 | 26 | 26 | None | None | None | None |
| Prasad, Nadipuram | PhD, 1989 | ASC | T | FT | 15 | 26 | 26 | None | Low | Medium | None |
| Ramirez-Angulo, Jaime | PhD, 1982 | P | T | FT | 0.5 | 29 | 22 | None | Low | Low | Low |
| Ranade, Satish | PhD, 1981 | P | T | FT | 2 | 31 | 31 | None | High | High | High |
| Stochaj, Steven | PhD, 1990 | P | T | FT | 2 | 26 | 21 | None | Medium | High | None |
| Voelz, David | PhD, 1987 | P | T | FT | 14 | 10 | 10 | None | High | High | Medium |

**Table 6-1.d.** Faculty Qualifications – Department of Chemical & Materials Engineering

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Faculty Name** | **Highest Degree Earned- Field and Year** | **Rank 1** | **Type of Academic Appointment2**  **T, TT, NTT** | **FT or PT3** | **Years of Experience** | | | **Professional Registration/ Certification** | **Level of Activity4**  **H, M, or L** | | |
| **Govt./Ind. Practice** | **Teaching** | **This Institution** | **Professional Organizations** | **Professional Development** | **Consulting/summer work in industry** |
| Paul Andersen | Ph.D. Chemical Engineering 1987 | ASC | T | FT |  | 21 | 19 |  | L | M | L |
| Catherine Brewer | PhD. Chemical Engineering 2012 | AST | TT | FT | 0 | 4 | 4 |  | H | H | L |
| Reza Foudazi | Ph.D. Chemical Engineering 2010 | AST | TT | FT |  | 4 | 4 |  | H | H | L |
| Daniel Gulino | Ph.D. Chemical Engineering 1983 | A | NTT | PT |  | 29 | 4 |  | L | L | L |
| Jessica Houston | Ph.D. Chemical Engineering 2005 | ASC | T | FT | 2 | 7 | 7 |  | H | H | L |
| Umakana Jena | PhD. Agricultural Engineering 2011 | AST | TT | FT |  | 1 | 0 |  | H | H | L |
| Hongmei Luo | Ph.D. Chemical Engineering 2006 | ASC | T | FT | 2 | 7 | 7 |  | H | H | L |
| Thomas Manz | Ph.D. Chemical Engineering 2009 | AST | TT | FT |  | 5 | 5 | MA bar | H | M | L |
| Martha Mitchell | Ph.D. Chemical Engineering 1996 | P | T | FT |  | 20 | 20 | PE, NAFI CFEI, OSHA Outreach Trainer | H | H | L |
| Theodore Nelson | Ph.D. Chemical Engineering 1971 | A | NTT | PT | 53 | 9 | 0.5 | PE | H | M | H |
| Ila Pillamarri | Ph.D. Health Physics | A | NTT | PT |  | 2 | 2 |  | M | L | L |
| David Rockstraw | Ph.D.Chemical Engineering 1989 | P | T | FT | 27 | 21 | 21 | PE | H | M | M |
| Alicia Salazar | MS. Nuclear Engineering 2014 | A | NTT | PT | 3 | 1 | 1 |  | M | M | L |
| Neda Sanatkaran | Ph.D. Chemical Engineering 2015 | A | NTT | PT | 5 | 2 | 1 |  | M | M | L |
| John Schutte | BS Chemical Engineering 1999 | A | NTT | PT | 12 | 4 | 4 |  | M | M | L |
| Stephen Taylor | Ph.D. Chemical Engineering 2004 | A | NTT | PT | 0 | 6 | 4 |  | L | L | L |
| Meng Zhou | Ph.D. Chemical Engineering 2016 | AST | TT | PT | 0 | 2 | 2 |  | M | M | L |

1. Code: P = Professor ASC = Associate Professor AST = Assistant Professor I = Instructor A = Adjunct O = Other

2. Code: T = Tenured TT = Tenure Track NTT = Non Tenure Track

3. Code: FT = Full-time PT = Part-time Appointment at the institution.

4. The level of activity (high, medium or low) should reflect an average over the year prior to the visit plus the two previous years.

**Table 6-2.a.** Faculty Workload Summary – Department of Physics

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Faculty Member (name)** | **PT or FT1** | **Classes Taught**  **(Course No./Credit Hrs.)**  **Term and Year2** | **Program Activity Distribution3** | | | **% of Time Devoted**  **to the Program5** |
| ***Teaching*** | ***Research or Scholarship*** | ***Other4*** |
| Matthias Burkardt | FT | Phys 315 (3) Spring 2018  PHYS 455 (3) Spring 2018 | 25 | 65 | 10 | 12 |
| Michaela Burkardt | PT | PHYS 217 (3) Fall 2017  PHYS 217L (1) Fall 2017  PHYS 280 (1) Fall 2017  PHYS 214 (3) Spring 2018  PHYS 204 (1) Spring 2018 | 95 | 0 | 5 | 27 |
| Robert Cooper | FT | PHYS 462 (3) Spring 2018 | 15 | 79 | 6 | 10 |
| Michael De Antonio | PT | PHYS 215G (3) Spring 2018 | 90 | 0 | 10 | 16 |
| Michael Engelhardt | FT | PHYS 213 (3) Fall 2017  PHYS 495 (3) Fall 2017  PHYS 454 (3) Fall 2017 | 45 | 45 | 10 | 22 |
| Edwin Fohtung | FT | PHYS 303V (3) Spring 2018 | 18 | 70 | 12 | 17 |
| Thomas Hearn | FT | PHYS 305V (3) Fall 2017  PHYS 215G (3) Spring 2018  PHYS 215GL (1) Spring 2018 | 45 | 45 | 10 | 34 |
| Boris Kiefer | FT | PHYS 476 (3) Spring 2018 | 35 | 60 | 5 | 10 |
| Heinz Nakotte | FT | PHYS 461 (3) Fall 2017  PHYS 216GL (1) Fall 2017  PHYS 216G (3) Spring 2018 | 40 | 40 | 20 | 37 |
| Stephen Pate | FT | PHYS 215G (3) Fall 2017  PHYS 480 (3) Spring 2018  PHYS 315L (3) Spring 2018 | 40 | 50 | 10 | 35 |
| Marc Schlegel | FT | none | 20 | 75 | 5 | 0 |
| Jacob Urquidi | FT | PHYS 395 (3) Fall 2017  PHYS 475 (3) Spring 2018  PHYS 216G (3) Spring 2018 | 60 | 30 | 10 | 24 |
| Igor Vasiliev | FT | none | 42.5 | 47.5 | 10 | 13 |
| Lauren Waszek | FT | PHYS 451 (3) Fall 2017  PHYS 216G (3) Fall 2017  PHYS 216G (1) Spring 2018 | 45 | 50 | 5 | 22 |
| Stefan Zollner | FT | PHYS 468 (3) Fall 2017  PHYS 213L (1) Fall 2017  PHYS 214L (1) Spring 2018  PHYS 489 (3) Spring 2018 | 30 | 15 | 55 | 22 |
| Francisco Carreto-Parra | FT | PHYS 215GL (1) Summer 2018  PHYS 216GL (1) Summer 2018 | 80 | 0 | 20 | 20 |
| Fatma Aslan | PT | PHYS 216G (3) Fall 2017  PHYS 380 (1) Spring 2018 | 55 | 45 | 0 | 30 |
| Federico Alvarez | PT | PHYS 203 (1) Fall 2017  PHYS 205 (1) Fall 2017  PHYS 206 (1) Fall 2017 | 100 | 0 | 0 | 50 |
| Galen Helms | PT | PHYS 215GL (1) Fall 2017 | 100 | 0 | 0 | 25 |
| Greggory McPherson | PT | PHYS 215G (3) Fall 2017 | 100 | 0 | 0 | 50 |

FT = Full Time Faculty or PT = Part Time Faculty, at the institution

For the academic year for which the self-study is being prepared (2017/18 academic year).

Program activity distribution should be in percent of effort in the program and should total 100%. Figures are for 2017/18 academic year.

Indicate sabbatical leave, etc., under "Other."

Out of the total time employed at the institution (see text for explanation).

**Table 6-2.b.** Faculty Workload Summary – Department of Mechanical & Aerospace Engineering

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Faculty Member (name)** | **PT or FT1** | **Classes Taught**  **(Course No./Credit Hrs.)**  **Term and Year2** | **Program Activity Distribution3** | | | **% of Time Devoted**  **to the Program5** |
| ***Teaching*** | ***Research or Scholarship*** | ***Other4*** |
| Abdelkefi, Abdessattar | FT | Fall 2017 – ME 333/3cr, ME 509/3cr  Spring 2018 – ME 237/3cr, ME 510/3cr | 45% | 50% | 5% | 100% |
| Armstrong, Terry | PT | Fall 2017 – ME 228/3cr, ME 445/3cr  Spring 2018 – AE 424/3cr, ME 228/3cr, ME 445/3cr | 100% |  |  | 100% |
| Chaitanya, Vimal | FT | Fall 2017 – Research Buyout  Spring 2018 – ME 236/3cr with one course buyout | 50% | 20% | 30% | 100% |
| Chen, Ruey-Hung | FT | Fall 2017 – AE 419/3 cr | 25% | 25% | 50% DH | 100% |
| Choo, Vincent | FT | Fall 2017 – ME 3345/3cr, ME 237/3cr  Spring 2018 – ME 345/3cr, ME 240/3cr | 50% | 30% | 20% | 100% |
| Conley, Edgar | FT | Fall 2017 – ME 326/3 cr, ME 425/3cr, ME 449/1cr  Spring 2018 – Sick Leave (SL) | 50% | 30% | 20% | 100% |
| Drach, Borys | FT | Fall 2017 – ME 236/3cr, ME 518/3cr  Spring 2018 – ME 236/3cr, ME 580/3cr | 50% | 45% | 5% | 100% |
| Garcia, Gabriel | FT | Fall 2017 – ME 261/3cr  Spring 2018 – ME 261/3cr, ME 460/3cr | 50% | 20% | 30% | 100% |
| Gross, Andreas | FT | Fall 2017 – AE 451/3cr, AE 510/3cr  Spring 2018 – ME 533/3cr | 45% | 50% | 5% | 100% |
| Kota, Krishna | FT | Fall 2017 – ME 240/3cr, ME 341/3cr  Spring 2018 – ME 341/3cr, ME 540/3cr | 50% | 45% | 5% | 100% |
| Kuravi, Sarada | FT | Fall 2017 – ME 340/3cr, ME 481/3cr  Spring 2018 – ME 340/3cr, ME 481/3cr | 50% | 45% | 5% | 100% |
| Lee, Young S. | FT | Fall 2017 – AE 364/3cr, ME 328/3cr  Spring 2018 – AE 363/3cr, AE 405/3cr | 45% | 40% | 15% | 100% |
| Park, Hyeongjun | FT | Spring 2017 – new faculty | 45% | 50% | 5% | 100% |
| Park, Young-Ho | FT | Fall 2017 – ME 426/3cr, ME 427/3cr  Spring 2018 – ME 426/3cr, ME 427/3cr | 50% | 40% | 10% | 100% |
| Sevostianov, Igor | FT | Fall 2017 – ME 510/3cr, ME 570/3cr  Spring 2018 – ME 331/3cr, ME 502/3cr | 45% | 45% | 10% | 100% |
| Shashikanth, Banavara | FT | Fall 2017 – ME 240/3cr, ME 328/3cr  Spring 2018 – ME 240/3cr, ME 328/3cr | 45% | 45% | 10% | 100% |
| Shu, Fangjun | FT | Fall 2017 – AE 339/3cr, AE 447/3cr  Spring 2018 – AE 439/3cr, AE 447/3cr | 50% | 35% | 15% | 100% |
| Sun, Liang | FT | Fall 2017 – ME 210/3cr  Spring 2018 – ME 210/3cr, ME 487/3cr | 50% | 40% | 10% | 100% |

FT = Full Time Faculty or PT = Part Time Faculty, at the institution

For the academic year for which the self-study is being prepared (2011/12 academic year).

Program activity distribution should be in percent of effort in the program and should total 100%. Figures are for 2011 calendar year.

Indicate sabbatical leave, etc., under "Other."

Out of the total time employed at the institution (see text for explanation).

**Table 6-2.c.** Faculty Workload Summary – Department of Electrical & Computer Engineering

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Faculty Member | PT or FT | Classes Taught (credit) 2011-2012 | Program Activity Distribution | | | % of Time Devoted  to the Program |
| Teaching | Research or Scholarship | Other |
| Borah, Deva | FT | Fall 2016: EE 210 (4), 571 (3), GSS1 | 50% | 30% | 20% | 70% |
| Spring 2018: EE 497 (3), 581 (3), 583 (3), GSS1 |
| Boehmer, Charles | PT  (25%) | Fall 2011: EE 461 (3) | 100% | 0% | 0% | 100% |
| Spring 2012: EE 460 (3) |
| Boucheron, Laura | FT | Fall 2011: EE 545 (3), GSS1 | 35% | 60% | 5% | 50% |
| Spring 2012: EE 314 (4), GSS1 |
| Brahma, Sukumar | FT | Fall 2011: EE 391 (4), 431 (3), 542 (3), GSS1 | 40% | 50% | 10% | 50% |
| Spring 2012: EE 534 (3), GSS1 |
| Cho, Sang-Yeon | FT | Fall 2011: EE 425 (3), 525 (3), GSS1 | 35% | 60% | 5% | 35% |
| Spring 2012: EE 380 (4), GSS1 |
| Cook, Jeanine | FT | Fall 2011: EE 419 (3), GSS1 | 25% | 50% | 25% | 50% |
| Spring 2012: EE 563 (3), GSS1 |
| Creusere, Charles | FT | Fall 2011: EE 312 (3), 418 (3), GSS1 | 25% | 50% | 25% | 40% |
| Spring 2012: EE 210 (4), 446 (3), 596 (3), GSS1 |
| Dawood, Muhammed | FT | Fall 2011: EE 351 (4), GSS1 | 30% | 60% | 10% | 50% |
| Spring 2012: EE 351 (4), 454 (3), 541 (3), GSS1 |
| DeLeon, Phillip | FT | Fall 2011: EE 395 (3), 419 (3), GSS1 | 25% | 40% | 35% | 45% |
| Spring 2012: EE 565 (3), GSS1 |
| Furth, Paul | FT | Fall 2011: EE 418 (3), 486 (3), 524 (3), GSS1 | 55% | 35% | 10% | 65% |
| Spring 2012: EE 201 (3), 419 (3), 526 (3), GSS1 |
| Huang, Hong | FT | Fall 2011: EE 260 (4), 469 (3), GSS1 | 35% | 55% | 10% | 40% |
| Spring 2012: EE 161 (4), GSS1 |

1 GSS = Graduate Student Supervision: variable credit for EE 590 (Selected Topics), EE 598 (Master’s Technical Report), EE 599 (Master’s Thesis), EE 600 (Doctoral Research), 700 (Doctoral Dissertation.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Faculty Member | PT or FT | Classes Taught (credit) 2011-2012 | Program Activity Distribution | | | % of Time Devoted  to the Program |
| Teaching | Research or Scholarship | Other |
| Kliewer, Joerg | FT | Fall 2011: EE 555 (3), GSS1 | 30% | 60% | 10% | 30% |
| Spring 2012: EE 312 (3), GSS1 |
| Liu, Wenxin | FT | Fall 2011: EE 109 (3), 531 (3), GSS1 | 35% | 60% | 5% | 40% |
| Spring 2012: EE 391 (4), GSS1 |
| Ng, Kwong | FT | Fall 2011: EE 310 (3), 515 (3), GSS1 | 50% | 40% | 10% | 50% |
| Spring 2012: EE 310 (3), GSS1 |
| Oklobdzija,Vojin | FT | Fall 2011: GSS1 (department head) | 0% | 25% | 75% | 75% |
| Spring 2012: EE 418 (3), GSS1 |
| Paz, Robert | FT | Fall 2011: EE 314 (4), 475 (3), 551 (3), GSS1 | 30% | 55% | 15% | 45% |
| Spring 2012: EE 260 (4), 476 (3), GSS1 |
| Petersen, Krist | FT | Fall 2011: EE 161 (4) | 50% | 0% | 50% | 100% |
| Spring 2012: EE 162 (4), 363 (4) |
| Prasad, Nadipuram | FT | Fall 2011: EE 201 (3), GSS1 | 45% | 45% | 10% | 45% |
| Spring 2012: GSS1 (sabbatical) |
| Ramirez-Angulo, Jaime | FT | Fall 2011: EE 380 (4), 482 (3), GSS1 | 30% | 60% | 10% | 30% |
| Spring 2012: EE 485 (3), 523 (3), 519 (3), GSS1 |
| Ranade, Satish | FT | Fall 2011: EE 280 (4), 418/419 (3), 544 (3), GSS1 | 45% | 35% | 20% | 65% |
| Spring 2012: EE 280 (4), 418/419 (3), 493 (3) 543 (3), GSS1 |
| Stochaj, Steven | FT | Fall 2011: EE 109 (3), 162 (4), 418 (3), GSS1 | 30% | 40% | 30% | 80% |
| Spring 2012: EE 418/419 (3), 460 (3), GSS1 |
| Voelz, David | FT | Fall 2011: EE 478 (4), 528 (4), GSS1 | 30% | 60% | 10% | 40% |
| Spring 2012: EE 577 (3), GSS1 |

1 GSS = Graduate Student Supervision: variable credit for EE 598 (Master’s Technical Report), EE 599 (Master’s Thesis), EE 600 (Doctoral Research), 700 (Doctoral Dissertation)

**Table 6-2.c.** Faculty Workload Summary – Department of Chemical & Materials Engineering

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Faculty Member (name)** | **PT or FT1** | **Classes Taught**  **(Course No./Credit Hrs.)**  **Term and Year2** | **Program Activity Distribution3** | | | **% of Time Devoted**  **to the Program5** |
| ***Teaching*** | ***Research or Scholarship*** | ***Other4*** |
| Paul Andersen | FT | 17FA: 452(3), 470(3); 18SP: sabbatical | 25 | 20 | 55 |  |
| Catherine Brewer | FT | 17FA: 306(4); 18SP: 301(3), 491(1.5), 495(2) | 43.8 | 51.3 | 5 |  |
| Reza Foudazi | FT | 17FA: 361(3); 18SP: 305(3), 506(3) | 37.5 | 57.5 | 5 |  |
| Daniel Gulino | PT | 17FA: 323L(1), 423L(1); 18SP: 324L(1), 424L(1) | 100 |  |  |  |
| Jessica Houston | FT | 17FA: 412(3); 18SP sabbatical | 12.5 | 32.5 | 55 |  |
| Umakana Jena | FT | 17FA: 201(3); 18SP: 441(3) | 25 | 70 | 5 |  |
| Hongmei Luo | FT | 17FA: 302(2), 467/567(3) | 20.8 | 74.2 | 5 |  |
| Thomas Manz | FT | 17FA: 516(3); 18SP: 307(3), 461/561(3) | 37.5 | 57.5 | 5 |  |
| Juanita Miller | PT | 18SP: 449(3) | 100 |  |  |  |
| Martha Mitchell | FT | 17FA: sabbatical; 18SP: 102(2), 392(3), 594(2), 690(1) | 33.3 | 11.7 | 55 |  |
| Nelson, Theodore | PT | 17FA: 501(3) | 100 |  |  |  |
| Ila Pillamarri | PT | 18SP: 471(3) | 100 |  |  |  |
| David Rockstraw | FT | 17FA: 101(2), 391(1) | 12.5 | 17.5 | 70 |  |
| Salazar, Alicia | PT | 17FA: 491(3) | 100 |  |  |  |
| Sanatkaran, Neda | PT | 18SP: 361(3) | 12.5 | 82.5 |  |  |
| John Schutte | PT | 17FA: 302L(1), 452L(1); 18SP: 352L(1), 455(3), 455L(1) | 25 | 75 |  |  |
| Stephen Taylor | PT | 17FA: 395V(3); 18SP: 395V(3), 491(1.5), 495(2) | 100 |  |  |  |
| Zhou, Meng | FT | none | 0 | 50 | 50 |  |

FT = Full Time Faculty or PT = Part Time Faculty, at the institution

For the academic year for which the self-study is being prepared (2011/12 academic year).

Program activity distribution should be in percent of effort in the program and should total 100%. Figures are for 2011 calendar year.

Indicate sabbatical leave, etc., under "Other."

Out of the total time employed at the institution (see text for explanation).

# CRITERION 7. FACILITIES

## A. Offices, Classrooms and Laboratories

*Summarize each of the program’s facilities in terms of their ability to support the attainment of the student outcomes and to provide an atmosphere conducive to learning.*

*Offices**(such as**administrative,**faculty, clerical, and teaching assistants) and any associated equipment that is typically available there.*

The Department of Physics office is located in Room GN 221 Gardiner Hall, in close proximity to classrooms and faculty offices. This office has three separate areas for the administrative assistant (GN 221), the fiscal assistant (GN 222) and the department head (GN 223). The office has a small seating area (for student waiting for appointments with the department head), a refrigerator, a microwave oven, and a coffee machine (which is often used by the students). This office area welcomes students seeking assistance from the department head or clerical staff, especially in matters relating to academic and career advising, entrance and exit interviews, course registration, and substitutions and waivers for degree certification. Next door (GN 224) is the mailroom with individual mail slots for all faculty, staff, and graduate students. This room also has a high-volume duplex photocopier and scanner and a fax machine.

Physics faculty and two technical (exempt) staff members have individual offices in Gardiner Hall, on the 2nd and 3rd floors. Each office is about 190 sq. ft. After the recent renovation of Gardiner Hall, all offices have modern furniture, thermostatically controlled HVAC, hardwired internet, and multi-function telephones with teleconferencing, messaging, call-forwarding, etc.

Graduate students (including teaching and research assistants) have offices either in large office suites broken up into cubicles, or they share smaller faculty-sized offices in various locations in the building. Occasionally, office space is also provided to undergraduate students who are particularly engaged in the department through undergraduate research, capstone projects, outreach, or clerical or technical work.

Student Societies: The Department of Physics has two very active chapters of the Society of Engineering and Physics (SEPh) and the Society of Physics Students (SPS), a national organization operated by the American Institute of Physics. The SPS chapter has been recognized as an “Outstanding Chapter” several times in recent years by the national parent organization. Although independent, the two societies interact with each other, and both have dedicated rooms in Gardiner Hall, where they hold meetings, study groups, and other social functions. The student society rooms have refrigerators, microwave ovens, toasters, and coffee machines. They also have an A-frame whiteboard for student societies to announce their activities and a blackboard, where students collaborate in solving their homework problems. All physics and EP students have key card access to these two rooms.

*Classrooms and associated equipment that are typically available where the program courses are taught.*

The Department of Physics conducts almost all of its lecture classes in four classrooms in Gardiner Hall. All four classrooms have multi-media capabilities, including ceiling-mounted projectors, very large screens, CD players, and document cameras. Physics students and faculty still prefer blackboards and chalk over whiteboards. Such blackboards are available in all regularly used classrooms and instructional laboratories and other areas of the building.   
  
The largest classroom, Gardiner 230, seats about 110 students; this classroom is used for the large engineering classes, such as PHYS 215G and 216G. The next largest, Gardiner 229, seats about 65 students; this is used for the smaller more intensive classes PHYS 213, 214, 217, and 315. Gardiner 218A, which seats about 24 students, is used for upper-division classes like PHYS 454, 455, 461, 462, 480, 489, etc. Gardiner 218 is a highly flexible multi-media classroom with circular tables and multiple PC displays, more suited for a workshop atmosphere and remote instruction, and it is used for instructional seminars and other somewhat informal instructional support functions. The Geological Sciences Department (also located in Gardiner Hall) rarely uses these classrooms. They are therefore available to for physics courses on a priority basis. At other times (when the rooms are needed for physics or geology courses), these classrooms are available to other departments in the university.

*Laboratory facilities including those containing computers (describe available hardware and software) and the associated tools and equipment that support instruction. Include those facilities used by students in the program even if they are not dedicated to the program and state the times they are available to students. Complete Appendix C containing a listing of the major pieces of equipment used by the program in support of instruction.*

The Department of Physics supports a variety of instructional laboratories. Four large labs, Gardiner 104, 108, 204, and 206 (each about 900-1000 sq. ft., providing space for 20-24 students per section in groups of 2-3) are used for the Introductory Laboratory classes PHYS 213L, 214L, 215GL, 216GL, and 217L. The Modern Physics Laboratory, PHYS 315L, is run in a dedicated lab space with two rooms, Gardiner 131 and 132, which are about 800 sq. ft. in size. The Advanced Physics Laboratory, PHYS 475, is operated in several laboratory spaces throughout Gardiner Hall (some of which are also research laboratories) as well as in central university facilities, such as the Central University Research Resource Laboratory (CURRL) operated by the Vice President for Research with a dedicated staff scientist. In the advanced PHYS 315L and 475 labs, the students are required to do some experimental design work, after they have become familiar with the apparatus available. We also have dedicated space for Outreach and Physics Demonstrations (Gardiner 142), which can also be used as a laboratory for a capstone project for EP majors.

Table 7.1 provides a detailed list of all rooms (except for storage facilities) of the Department of Physics in Gardiner Hall. Their primary purpose (office space, research, teaching, etc) is also indicated.

**Table 7.1.** Department of Physics rooms in Gardiner Hall; allocation, occupant(s), number of computer stations, room size and primary purpose. GA, RA and TA indicate graduate, research and teaching assistants, respectively.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Office Number** | **Room Allocation** | **Occupant Name** | **Capacity** | **Size (sq.ft.)** | **Primary Purpose** |
| 050 | Materials Science Lab | Dr. Bruce | 0 | 224 | Research |
| 054 | Department Wet Lab | Dr. Zollner | 0 | 186 | Research |
| 055 | Res. Assist. Office | 6 RAs | 6 | 382 | Office |
| 057 | Research Lab | Dr. Cooper | 0 | 188 | Research |
| 058 | Materials Science Lab | Dr. Urquidi | 0 | 157 | Research |
| 060 | X-RAY Lab | Dr. Urquidi | 0 | 1559 | Research |
| 062 | Experimental Lab | Dr. Urquidi | 0 | 92 | Research |
| 063 | Faculty Office | Dr. Urquidi | 1 | 93 | Office |
| 065 | Adv. Phys. Lab |  | 10 | 367 | Teaching Lab |
| 065A | Radioactive Storage | Dr. Pate | 0 | 70 | Support |
| 066 | Adv. Phys. Lab |  | 10 | 682 | Teaching Lab |
| 069 | Materials Science Lab | Dr. Urquidi | 0 | 183 | Research |
| 102 | Emeritus Faculty Office | Dr. Goedecke | 1 | 160 | Office |
| 103 | Materials Science Lab | Dr. Bruce | 1 | 119 | Office |
| 104 | Physics Teaching Lab |  | 20 | 885 | Teaching Lab |
| 106 | Class Lab Storage |  | 0 | 368 | Teaching Lab |
| 108 | Physics Teaching Lab |  | 20 | 1050 | Teaching Lab |
| 125 | Student Society Room | SPS | 2 | 283 | Office |
| 131 | Physics Teaching Lab |  | 20 | 496 | Teaching Lab |
| 132 | Modern Physics Lab |  | 3 | 286 | Teaching Lab |
| 132A | Modern Physics Lab |  | 7 | 309 | Teaching Lab |
| 132B | Modern Physics Lab |  | 0 | 97 | Teaching Lab |
| 142 | Outreach |  | 0 | 428 | Outreach |
| 201 | Grad Assistant Office | 4 TAs | 1 | 151 | Office |
| 202 | Grad Assistant Office | 4 TAs | 1 | 160 | Office |
| 203 | Adjunct Faculty Office | Dr. Wagner | 2 | 119 | Office |
| 204 | Physics Teaching Lab |  | 22 | 986 | Teaching Lab |
| 205 | Class Lab Storage |  | 0 | 332 | Teaching Lab |
| 206 | Physics Teaching Lab |  | 20 | 998 | Teaching Lab |
| 207 | Dept. Technician | Mr. Carreto-Parra | 1 | 181 | Office |
| 209 | Class Lab Storage |  | 2 | 237 | Teaching Lab |
| 216 | Grad Assistant Offices | 12 GAs | 12 | 524 | Office |
| 218 | Physics Teaching Lab |  | 24 | 493 | Teaching Lab |
| 218A | Classroom |  | 24 | 489 | Classroom |
| 221 | Department Office | (vacant) | 1 | 332 | Office |
| 222 | Res. Acc. Office | Ms. Christensen | 1 | 123 | Office |
| 223 | Dep. Head Office | Dr. Zollner | 5 | 212 | Office |
| 225 | Tutoring Room |  | 0 | 317 | Open Lab |
| 229 | Lecture Hall |  | 65 | 897 | Classroom |
| 230 | Lecture Hall |  | 110 | 1409 | Classroom |
| 231 | Class Storage |  | 0 | 291 | Classroom |
| 250 | College Faculty Office | Dr. De Antonio | 1 | 130 | Office |
| 250A | Closet |  | 0 | 31 | Office |
| 251 | College Faculty Office | Dr. Mi. Burkardt | 1 | 130 | Office |
| 254 | Faculty Office | Dr. Zollner | 1 | 183 | Office |
| 255 | Faculty Office | Dr. Urquidi | 1 | 189 | Office |
| 256 | Emeritus Faculty Office | Dr. Gibbs,  Dr. Kanim | 1 | 193 | Office |
| 256A | Faculty Office | Dr. Engelhardt | 1 | 185 | Office |
| 258 | Faculty Office | Dr. Waszek | 1 | 193 | Office |
| 258A | Faculty Office | Dr. Ma. Burkardt | 1 | 185 | Office |
| 259 | Faculty Office | Dr. Vasiliev | 1 | 187 | Office |
| 259A | Atmospheric Optics | Dr. Bruce | 1 | 187 | Office |
| 259B | Faculty Office | Dr. Bruce | 1 | 177 | Office |
| 260 | Atmosph. Optics Lab | Dr. Bruce | 0 | 561 | Research |
| 261 | Conf. Room & Library |  | 20 | 835 | Office |
| 264 | Computer lab & SEPh |  | 14 | 835 | Teaching Lab |
| 265 | Optics Research Lab |  | 0 | 747 | Research |
| 266 | Office Storage |  | 0 | 181 | Support |
| 267 | Post Doc Office | Dr. Jelinek | 1 | 131 | Office |
| 268 | Emeritus Faculty Office | Dr. Ni | 1 | 141 | Office |
| 352B | Faculty Office | Dr. Schlegel | 1 | 196 | Office |
| 353 | Faculty Office | Dr. Hearn | 1 | 193 | Office |
| 354 | Faculty Office | Dr. Kiefer | 1 | 194 | Office |
| 355 | Faculty Office | Dr. Papavassiliou | 1 | 194 | Office |
| 356 | Faculty Office | Dr. Pate | 1 | 192 | Office |
| 357 | Faculty Office | Dr. Nakotte | 1 | 194 | Office |
| 358 | Faculty Office | Dr. Cooper | 1 | 193 | Office |
| 359 | Technician Office | Mr. Hossain | 1 | 167 | Office |
| 361 | Grad Assistant Office | 6 RAs | 6 | 573 | Office |
| 362 | Research Lab | Dr. Nakotte | 0 | 568 | Research |
| 363 | Grad Assistant Office | 6 RAs | 6 | 568 | Office |
| 364 | Nuclear Physics Lab | Dr. Pate | 0 | 761 | Research |
| 365 | Geophysics Res. Lab | Dr. Waszek | 0 | 571 | Research |
| 366 | Geophysics Res. Lab | Dr. Hearn | 0 | 165 | Research |

## B. Computing Resources

*Describe any computing resources (workstations, servers, storage, networks including software) in addition to those described in the laboratories in Part A, which are used by the students in the program. Include a discussion of the accessibility of university-wide computing resources available to all students via various locations such as student housing, library, student union, off-campus, etc. State the hours the various computing facilities are open to students. Assess the adequacy of these facilities to support the scholarly and professional activities of the students and faculty in the program.*

The Department of Physics has 19 computer workstations in our computer laboratory, most with the Linux-operating system but several with the Windows-operating system. All of these computers run MATLAB through a campus license. Some also have specialized software like Origin (for preparation of publication-quality figures) or an x-ray data analysis suite. These computers are used in support of the PHYS 150 and PHYS 476 computational physics courses. Physics and EP majors can have accounts on these computers for use in other projects. For example, students in the PHYS 315L advanced lab are expected to use a variety of computing tools to collect and analyze data. Access to this physics computer laboratory is given around the clock to students and staff associated with the physics department. This room also serves as the home for the student Society of Engineering and Physics (SEPh). Except when in use as a classroom (two afternoons in the fall semester), there is no competition for access to these computers and there are no wait times.

Apart from departmental computing resources, it should be noted that wireless access is available throughout Gardiner Hall as well as most the NMSU campus and students can have access to many other computer laboratories across campus, see Table 7.2.

**Table 7.2:** Public and semi-public computer laboratories across the NMSU Main campus, showing computers available to students.

|  |  |  |  |
| --- | --- | --- | --- |
| **Lab** | **Type** | **Department** | **# of Computers** |
| Academic Research Building (ARB B 106) | Departmental/Semi-public | Training Central | 13 |
| Academic Research Building (ARC B 101) | Departmental/Semi-public | Training Central | 12 |
| Breland (BR) 175 (GAS) | Departmental/Semi-public | Arts & Sciences | 31 |
| Breland (BR) 192 (Geography) | Departmental/Semi-public | Arts & Sciences | 10 |
| Breland Lobby (BRLOB) | Public | Information & Communication Technologies | 6 |
| Business Lab (BC 309) | Departmental/Semi-public | Business | 62 |
| Clara Belle Williams (EN) 102 | Departmental/Semi-public | Arts & Sciences | 16 |
| Clara Belle Williams (EN) 121 | Departmental/Semi-public | Arts & Sciences | 27 |
| Computer Center Hallway (Cnhal)(ICT Building) | Public | Information & Communication Technologies | 10 |
| Corbett Center, 1st Floor (CCL) | Public | Information & Communication Technologies | 8 |
| Corbett Center, Pete's Place Lab (Petes), 2nd Floor | Public | Information & Communication Technologies | 43 |
| ECII 125 | Departmental/Semi-public | Engineering | 28 |
| ECIII 134 | Departmental/Semi-public | Engineering | 10 |
| Frenger Food Court | Public | Information & Communication Technologies | 3 |
| Fulton (FAC) 148 | Departmental/Semi-public | Athletics | 17 |
| Fulton (FAC) 149 | Departmental/Semi-public | Athletics | 9 |
| Gerald Thomas (Aggie Snack Bar/Old Blakes Lot-A-Burger) | Public | Information & Communication Technologies | 3 |
| Hardman & Jacobs (HJLC) 101, 1st Floor | Public | Information & Communication Technologies | 49 |
| Hardman & Jacobs (HJLC) 128, Student Success Center | Public | Student Success Center | 15 |
| Hardman & Jacobs (HJLC) 206, Training/Classroom Lab | Public | Information & Communication Technologies | 24 |
| Health & Social Services (HSS) Cantina | Public | Information & Communication Technologies | 3 |
| Knox Hall Lab (KN), West Entrance | Public | Information & Communication Technologies | 18 |
| Math Success (Walden Hall) | Public | Arts & Sciences | 13 |
| Milton Hall (MH) 154, Journalism (Photo Journalism) | Departmental/Semi-public | Arts & Sciences | 19 |
| Milton Hall (MH) 154A, Journalism (Jour) | Departmental/Semi-public | Arts & Sciences | 16 |
| Milton Hall (MH) 157, Journalism (Jour) | Departmental/Semi-public | Arts & Sciences | 21 |
| O'Donnell Hall (OH) 033 | Departmental/Semi-public | Education | 26 |
| O'Donnell Hall (OH) 041 | Departmental/Semi-public | Education | 25 |
| Speech (SP) 315 | Departmental/Semi-public | Arts & Sciences | 24 |
| TB 202 | Departmental/Semi-public | Engineering | 22 |
| TB 203 | Departmental/Semi-public | Engineering | 22 |
| Vista Del Monte (VDM) Lab | Public | Information & Communication Technologies | 8 |
| Williams Annex 106a | Departmental/Semi-public | Arts & Sciences | 21 |
| Zuhl Library - Student Success | Public | Library | 16 |

## C. Guidance

*Describe how students in the program are provided appropriate guidance regarding the use of the tools, equipment, computing resources, and laboratories.*

Students, who take any of the instructional laboratories in the Department of Physics, will be given instructions and training on the proper and safe way to use the equipment, whenever it is deemed necessary and appropriate. Such instructions may be given at the beginning of each lab session (especially for the lower-division general-education laboratory courses) or at the beginning of the semester (for upper-division labs). While there are typically negligible (or only minor) safety concerns within the introductory 200-level laboratories, the higher-level laboratories (PHYS 315L and PHYS475) do require special instructions to protect the student from possible injury. For example, some of the experiments in PHYS 315L and 475 utilize ionizing radiation, such as X-rays. In general, students will be given specialized training and safety material on the proper and safe way to use potentially harmful equipment.

NMSU’s Environmental Health Safety & Risk Management (ESH&R) office (17 staff members) offers various safety training programs, publishes safety policies, and reviews safety procedures for all campus facilities, including research and instructional laboratories. Standard training courses are offered on a periodic schedule, while customized safety training sessions for a specific course can be offered by ESH&R personnel in the classroom at the regularly scheduled class time. For laboratories that pose potential safety hazards, students are required to review the safety materials, obey with the safety requirements (e.g. safety glasses are a ‘must’ for any of the Chemistry labs) and take a separate training course, if needed. Documen­tation and other information from NMSU’s ESH&R office can be reviewed at http://www.nmsu.edu/safety/.

It should also be noted that three of the department’s faculty members (Drs. Steve Pate, Vassilios Papavassiliou, Jacob Urquidi) are responsible for the use of radioactive sources in the building, and one of them (Dr. Steve Pate) is a member of the University’s Radiation Safety Committee.

Within the Department of Physics students are offered computing classes, such as PHYS 150 (optional) and PHYS 476 (elective), to train students in the use of computers in addressing physics problems. Moreover, all EP students take computing courses in Engineering as part of the engineering portion of their degree requirements. Additional courses, for example C++, Java, or object-oriented programming and numerical methods are offered by the NMSU Computer Science and Mathematical Sciences departments.

## D. Maintenance and Upgrading of Facilities

*Describe the policies and procedures for maintaining and upgrading the tools, equipment, computing resources, and laboratories used by students and faculty in the program.*

Gardiner Hall, which hosts the Department of Physics, underwent a major renovation from Fall of 2009 until Summer of 2010, at a total cost of about 13 M$. During that period, the building was completely vacated, and all offices and laboratories (both research and instructional) were temporarily relocated to other buildings on the NMSU campus. As part of the renovation, all classrooms and offices received new furniture and audiovisual equipment. Moreover, new desktop computers and color printers (or scanner/fax/printer units) were purchased for all faculty members. The renovated building now houses both the Department of Physics and the Department of Geological Sciences.

The Department of Physics has two exempt staff members (Francisco Carreto-Parra, MS in Physics, and Forhad Hossain, MS in Physics) who are charged with maintaining and upgrading the instructional laboratories and the computational facilities. They perform minor repairs, upgrades, and maintenance (often in collaboration with undergraduate students in physics or EP), order parts and supplies, and install new equipment. Costs are paid by the Physics Department’s operational funds or from the College of Engineering E-Fee (described in Criterion 8). Since it has been some time since new computers were purchased after the building renovation in 2010, we replace faculty and staff computers from time to time upon request, typically on a 3-4 year cycle. Also, the audiovisual classroom equipment was upgraded by NMSU Information and Communication Technologies (ICT) Department about 2-3 years ago, to transition from VGA to HDMI resolution and modern laptop connectors. NMSU computers are protected with a campus-wide anti-virus software (Sophos) maintained by ICT. All NMSU faculty and staff also have a campus-wide license for Microsoft Windows, Office, Adobe Acrobat, and other software.

In previous years, the institution used to solicit requests for Equipment Renewal and Replacement (ER&R) from the departments twice a year. Also, in the Fall semester, there used to be a call for requests to distribute Student Equipment Maintenance Fees. These funds could be used for equipment, software, maintenance, and supplies. Requests used to be routed from the Department of Physics through the College of Arts and Sciences to the central administration. Typical allocations to the Department of Physics used to be around 10 k$ per year. In recent years, this process was discontinued due to the difficult financial situation of the university, given several years of successive declining tuition revenue and state appropriations. These ER&R and student fee allocation funds were replaced with funds from the College of Engineering E-Fee, which are adequate, in the short term, to fill our needs for small equipment and supplies. Each spring, the Physics Department Head makes a request to the College of Engineering for distribution of E-Fee funds. Once allocated, the funds become available during the following academic year. Physics faculty and staff then request use of these funds from the department head and/or the laboratory committee (see below), who prioritize requests based on need and available funds.

Mr. Carreto-Parra and the Physics Department Head manage the NMSU inventory in the Department of Physics. The department has 498 inventory items for research and instructional purposes. These items are physically located and their barcodes are scanned once a year. Exceptions (items not found and scanned) are reported to the NMSU’s Board of Regents. By state law, inventory items are defined as items with an acquisition cost of USD 1000 or higher, regardless of age or depreciation. NMSU’s risk management includes property insurance with a 5000-dollar deductible for any theft and a 1000-dollar deductible for any loss due another covered occurrence.

While funds for new equipment are no longer available through ER&R requests from the central administration through the College of Arts and Sciences twice, such requests can now be made through the College of Engineering using the Engineering E-Fee. For example, we purchased a Germanium gamma ray detector in 2016 (25 k$) and several smaller pieces of electronic equipment from the E-Fee, to provide additional experimental stations for our growing EP program. We also purchased a classroom set of oscilloscopes for the PHYS 214L freshmen lab. Such equipment items can also be purchased from the department’s operational or foundation funds, on a limited basis. The Dr. Horace Coburn Physics Fund (annual earnings about 8 k$ per year) is used to purchase or build lecture demonstration or display equipment, for example the torsional oscillator purchased in 2013. The Coburn funds can also be used for EP capstone projects, if the purpose of these projects is to build demonstration of display equipment. Funds for instructional equipment can also be requested from government funding agencies, such as the National Science Foundation (NSF) and the Army Research Office (ARO). A previous NSF grant paid for equipment items in our instructional mechanics lab. Two ARO grants were received recently to purchase a powder and high-resolution x-ray diffractometer (used in PHYS 315L and PHYS 468 cross-listed with CHME 488) and a Fourier-transform infrared ellipsometer (used in PHYS 489 and 471). Finally, many of the faculty members engaged in the EP program have research grants which pay for computers, software, equipment, and facilities. Usually, these research laboratories can be used for undergraduate instruction or capstone projects on a limited case-by-case basis. Computers and software purchased from research funds for faculty and graduate students are typically also used to manage physics courses.

Repairs and maintenance of multimedia equipment in the classrooms are maintained by NMSU Information and Communication Technologies (ICT). The NMSU Office of Facilities and Services (F&S) provides janitorial services daily, which is adequate considering the use of the building. F&S also responds to work order requests for routine repairs. Emergency repairs (for example, a leaky faucet) are usually carried out rather quickly. The cost of routine building maintenance and repairs is covered by F&S. Recent maintenance included a replacement of the keycard access system to the building and selected rooms, because parts for the old system were no longer available. Once a year, each department used to request Building Repair and Renewal (BRR) funds from the central administration through the College of Arts & Sciences. This competition has been discontinued due to difficult fiscal situation.

The Department of Physics has a Laboratory Committee meets to discuss and prioritize the needs of the instructional labs. If competing requests exceed the available budget, then a decision is made concerning which requests need to be met first.

## E. Library Services

*Describe and evaluate the capability of the library (or libraries) to serve the program including the adequacy of the library’s technical collection relative to the needs of the program and the faculty, the adequacy of the process by which faculty may request the library to order books or subscriptions, the library’s systems for locating and obtaining electronic information, and any other library services relevant to the needs of the program.*

**Refer to Library Write-Up in Appendix? Or do we add it here?**

## F. Overall Comments on Facilities

*Describe how the program ensures the facilities, tools, and equipment used in the program are safe for their intended purposes. (See the 2017-2018 APPM section I.E.5.b.(1).)*

After the renovation of Gardiner Hall, the quality of the departmental facilities is greatly improved, although the Department of Physics lost ~30% of its pre-renovation space since the Department of Geological Sciences was moved into Gardiner Hall as well. Any future infrastructure work in the building will be done by the University Plant Services, to make sure all work done is up to code. Even with the loss of space, we believe that the current departmental facilities are superior compared to pre-renovation conditions. As a consequence, we are able to better serve the needs of our students and the different programs.

All rooms in Gardiner Hall classified as laboratories are inspected annually by the NMSU ESH&R department. Each chemical laboratory maintains a chemical inventory, which is checked annually for agreement with the actual chemicals stored in the room (usually in designated chemical storage spaces). Safety data sheets are kept on file in each chemical laboratory. Proper signage to inform students and staff about hazards is checked during the inspections. Findings are documented to the responsible faculty member with copy to the department head. They must be corrected within 30 days. The x-ray laboratory has area radiation monitors, which are replaced quarterly and only show background exposure. A state inspection of chemical laboratories in Gardiner Hall occurred in the fall of 2017 but did not have any findings. Chemical waste is removed from laboratories by designated ESH&R personnel upon request. ESH&R also performs annual radiation surveys in rooms containing radioactive sources.

On many occasions (especially in exit interviews), our EP students did indicate that needed facilities in the Department of Physics and in the participating engineering departments rank from ‘adequate’ to ‘excellent’, especially for the instructional laboratories.

# CRITERION 8. INSTITUTIONAL SUPPORT

## A. Leadership

*Describe the leadership of the program and discuss its adequacy to ensure the quality and continuity of the program and how the leadership is involved in decisions that affect the program.*

The Bachelor of Science in Engineering Physics (EP) is offered jointly by the Department of Physics in the College of Arts and Sciences and the Departments of Chemical and Materials Engineering, Electrical and Computer Engineering, and Mechanical and Aerospace Engineering in the College of Engineering. Degrees are awarded by the College of Engineering, but EP students have their academic home in the Department of Physics. This organizational structure is similar to University of Colorado at Boulder, with the difference that the UC Boulder EP program is not seeking ABET accreditation.

This highly interdisciplinary degree has been approved by the NMSU Board of Regents and is supported by the central administration, which is very supportive of interdisciplinary programs and faculty engagement across departmental and college boundaries. Both colleges support the program and provide leadership and advice, for example through interactions with the external Engineering Physics External Advisory Board (EPEAB), with the Physics Department Head, and through the Engineering Physics Program Committee (described later).

At the departmental level, leadership of the BS in EP program is shared between the Physics Department Head (Dr. Stefan Zollner), the EP Program Head (Dr. Heinz Nakotte), and the EP Program Committee (Dr. Nakotte, Dr. Hearn, Dr. Pate, Dr. De Antonio, Dr. Vasiliev, Dr. Luo, Dr. Stochaj, Dr. Park). If the Department Head goes on sabbatical (probably during the 2018/19 academic year), the Dean of Arts and Sciences will appoint an interim department head (probably Dr. Nakotte). A similar temporary replacement will be made if the EP Program Head goes on sabbatical (probably in the 2019/20 academic year).

The Department Head attends all department head meetings (and similar events) in the College of Arts and Sciences and as many as possible in the College of Engineering. If engineering meetings conflict with his teaching schedule, the EP program head will attend on his behalf. When the Department Head is absent from campus, he appoints an acting department head. In cases of scheduling conflicts between both colleges, he is represented by the EP program head or a member of the EP Committee. This arrangement allows complete tie-in of the Department of Physics and the EP program in both colleges. The role of the academic department head is described in the NMSU Administrative Rules and Procedures, especially Section 6.72. The Physics Department Head serves at the discretion of the Dean of the College of Arts and Sciences, with the concurrence of the executive vice president and provost. The Physics Department Head is evaluated annually by the Dean of the College of Arts and Sciences, with a more detailed 360 degree review every three to five years. Items most relevant to the leadership of the EP program are described below.

Responsibilities of the Physics Department Head include the following: academic leadership in teaching, research, and outreach; departmental collegiality; managing the budget, meeting reporting requirements to the institution and both colleges; scheduling of courses to meet the requirements of students enrolled in undergraduate and graduate programs; recruiting of undergraduate students and helping them get ready for their first semester; analysis of transfer credits from previous institutions; performance management of all staff, faculty, and teaching assistants in the Department of Physics (including mentoring and retention), assessment of the physics undergraduate and graduate programs in the College of Arts and Sciences, external representation of the department (college- and institution-wide, national societies, constituents, national laboratories, local industry, government agencies, alumni, donors, prospective students and their parents), ruling on academic and personnel appeals and grievances, assisting and advising of students, staff, and faculty in compliance with NMSU policies and procedures. The Department Head also performs all exit interviews with EP students and reports his findings to the EP Program Committee. He also seeks contact with program alumni.

Responsibilities of the EP Program Head include the following: assessment and accreditation of the EP program, coordination of EP student advising, leadership for the EP committee, representing the Physics Department Head when needed, recruiting and retention of EP students, new student registration in the College of Engineering.

The EP Committee is appointed by the Physics Department Head in consultation with the EP Program Head, the department heads of the participating engineering departments, and the Associate Dean for Academics in the College of Engineering. This committee is chaired by the EP Program Head. The Physics Department Head and the Associate Dean for Academics in the College of Engineering are ex officio members. The EP Committee has responsibility for the definition of the EP curricula and its concentrations. Its members assist with EP student advising (including degree checks and course substitutions), assessment and accreditation (continuous improvement of educational programs, courses, laboratory and computational facilities), recruiting, and retention. They update the advising documents, the EP degree pages in the catalog, the course descriptions, and the EP web pages. They also provide advice to other faculty in physics and in the participating engineering departments on their deliverables to the program (especially related to assessment of teaching effectiveness) and act as role models for other faculty.

The EP Program Committee works closely with other committees in the Department of Physics, especially the Curriculum Committee (chaired by Dr. Vasiliev), the Undergraduate Recruiting and Retention Committee (chaired by the Undergraduate Physics Program Head, Dr. Matthias Burkardt), the Computer Committee (chaired by Dr. Vasiliev), and the Laboratory Committee (chaired by Dr. Pate).

All departmental committees regularly update the entire physics faculty at departmental faculty meetings, which are held at least once a month. Special physics faculty meetings are held for important topics as needed, for example to review the Department’s Promotion and Tenure and other governance documents, to discuss candidates interviewed for an open faculty position, to discuss continuous improvement of outcomes and objectives of educational programs, to plan the strategy of the department for future directions, to decide on committee assignments, or to review the progress of undergraduate and graduate students towards degree completion. Each semester, a few days before the first day of classes, a half-day department meeting is held to allow more in-depth discussion. For example, in the spring of 2018 there was a long discussion if the department should seek ABET accreditation through the ANSAC commission for its BS in Physics program.

Important strategic decisions are made collegially by the physics faculty and reported to the College of Arts and Sciences (or Engineering) by the Physics Department Head. Tactical and operational details are decided by the Department Head following established university, college, and departmental procedures, usually after consulting the relevant committee chair.

To improve the governance of the Department of Physics, the faculty meet once a year without the department head (for example as part of a retreat before the semester) to discuss their satisfaction with departmental governance. The purpose of this meeting is to communicate to the Department Head, which decisions should be made by the Department Head, by faculty committees, or by the entire faculty. The faculty will provide feedback on decisions made over the past year and guidance for the following year. At this meeting, the faculty members also review which committees the department should form, what their duties should be, and they propose which faculty members should serve on various departmental, college, and university committees.

This leadership model is complicated, but also adequate for the needs of the program. Since EP is highly interdisciplinary, our model ensures that members of all relevant disciplines contribute to the leadership of the program. On the other hand, there is also a clear chain of command: Issues related to courses are determined by the course department head and course dean. Issues related to EP students and degrees are determined by the Physics Department Head (who acts as a department head in the College of Engineering for the purposes of the EP program) and the Office of the Dean of Engineering. The EP Program Head often acts for the Physics Department Head, in case the latter has conflicting responsibilities in both colleges.

## B. Program Budget and Financial Support

*Describe the process used to establish the program’s budget and provide evidence of continuity of institutional support for the program. Include the sources of financial support including both permanent (recurring) and temporary (one-time) funds.*

NMSU prepares annual budgets for current fund expenditures from unrestricted and restricted revenue sources. The annual cycle begins in November and coincides with the New Mexico Higher Education Department (NMHED) submission of the higher education funding recommendation to the state legislature. Funding priorities are established through a review of mandated requirements and strategic investments. The budgets are presented to the Board of Regents (BOR) for approval, prior to submission to state authorities.

The budgeting process starts with developing campus budget guidelines that identify sources and uses; priorities are identified through a collaborative and iterative process that begins with upper administration and expands to include the university budget office, deans, and the broader campus community. Feedback from all participants is used to further vet institutional priorities, which are then provided to the University Budget Committee (UBC) and the administration for consideration. The Regents Financial Strategies, Performance and Budget Committee (RFSPBC) participates through regularly scheduled meetings. While state funding for the budget year is determined, the list of priority investments is aligned to match available resources including tuition and fee adjustments.

The RFSPBC votes (regents abstaining) on proposed guidelines (which include tuition and fees) before they are presented to the full BOR for approval, usually in April. The BOR has final authority to approve budget guidelines, which are used to create the campus operating budget. Budgets are due to the NMHED by May 1st and may be 'pending' final approval (no later than May 19) by the BOR. NMHED has one month to review and submit budgets to the NM Department of Finance and Administration (DFA). The DFA has one month to review and send approvals to institutions by July 1, the beginning of the fiscal year. Budget office staff continuously monitors current year financial performance against the approved budget, and a Fiscal Watch certification is submitted quarterly to the NMHED. Modifications to the approved budget are allowed throughout the year, using the Budget Adjustment Request (BAR) process. The BAR must pass through the BOR prior to NMHED submission.

NMSU’s internal financial monitoring process includes a monthly review of budget exhibit fund balances and a comparison of current budget to actuals for revenue, expense and transfers on an aggregated basis for each established budget reporting unit. Colleges and departments are permitted to carry forward a percentage of unused funds from one fiscal year to the next, which provides a source of one-time funding to be used at the discretion of the College Dean or Vice President. If needed, individual units may be placed under fiscal watch for close monitoring, which includes periodic meetings between unit administrators, the Senior Vice President for Administration and Finance, and budget office staff to discuss budget status and other fiscal issues.

NMSU'S budgeted resources support the Institution's educational, research and service mission. In addition, NMSU has a strategic planning process that further aligns available resources with institutional priorities, expressed in five goals and operationalized through objectives and key performance indicators (KPIs). NMSU tracks use of centrally allocated resources to strategic goals, as does each college and major operational area.

In December of 2016, the BOR approved Six Pillars of Vision 2020, and eight key metrics associated with these pillars as a special focus of NMSU with regard to planning and budgeting. New investments in the 2018 budget are closely aligned with these pillars.

In 2013 NMSU introduced President's Performance Funding for short-term projects with potential for positive impact. Through a competitive application and hearing process, in January of 2014 the University Budget Committee (UBC) awarded $750,000 to finance 19 independent projects that supported various Vision 2020 objectives. Funding was renewed each year (for up to three years) based on milestone achievements. Current fiscal conditions prevent funding of additional projects, but all initiatives that met performance criteria were financed throughout the three years for which the initial award was intended. One of these funded projects was the Peer Learning Assistant (PLA) program, which provided undergraduate student peer mentors as PLAs for many undergraduate (especially STEM) courses. Embedding peer mentors in courses was very successful, but funding for the PLA program was not extended after the end of the three-year cycle and replacement funds could not be found.

NMSU engages in continuous processes to evaluate and improve operations at many levels. Such processes inform fiscal decisions and institutional planning. Examples include the Mercer and Deloitte studies, sustainability improvements and technology enhancements. Intensive efforts are also recognized through NMSU's Transforming exercises, which by Summer 2017 have resulted in real cost-savings to the university of $2.7 million, with an overall estimated project cost-savings of $9.7 million. The more recently developed Team 6 is focused on optimizing NMSU's academic structure to encourage collaboration and reduce administrative costs.

Other planning, budgeting and funding tied to assessment of student learning occurs at a more granular level. Colleges and departments may align resource allocation to student learning assessment outcomes. For example, in Fall 2014 the Engineering College revamped the core course for incoming engineering majors, ENGR 100. It is now paired with the freshman composition course (ENGL 111G), and in addition to regular assignments, special engineering design challenge assignments and multiple writing assignments are incorporated into the ENGL 111G class. Not only has fall-to-fall retention improved (from 62% prior to the intervention to an average of 76.8% over the last three years), it appears to be affecting greater retention of engineering students beyond the freshman to sophomore year.

Instructional funding such as faculty lines may be reallocated within the college at the discretion of the Dean with the approval of the Executive Vice President and Provost. Additionally, the Dean determines the new funding priorities for the College and presents the request to the Provost for consideration. The Provost may reallocate instructional funding among the Colleges or allocate any new funding in consultation with the Deans, Chancellor, and/or Administration and Finance.

The recurring total budget of the NMSU Department of Physics for the 2017/18 fiscal year (July 1st to June 30th) has four components, as listed below. The Department of Physics has six degree options, including BS and BA in Physics, BS in EP, MS in Physics, Ph.D. in Physics, and MS in Physics with a concentration in Space Physics. Expenditures towards these different degrees are not budgeted separately. The Department of Physics also teaches general education courses for about 1400 NMSU students each year.

The budget of the Department of Physics has been very stable (almost flat) for the past decade, indicating strong continuous institutional support considering the difficult financial situation of the university as a whole. Perhaps the institutional commitment to the Department reflects the fact that our student credit hour production has been stable and that our undergraduate headcount has grown significantly since 2010, while the same figures of merit have shrunk for the rest of the university. The biggest budgetary changes over the last six years are an increase in faculty salaries (to bring salaries of full professor to 90% of market salaries determined during a Mercer study) and an increase in teaching assistant stipends (since the cost of some benefits, especially health insurance, had to be cut due to new IRS regulations and were instead paid out as increased graduate assistant stipends). Similarly, the decrease in our operational funds is due to an accounting change, where the cost of phone lines and internet connections was moved from the departmental budget to a central account. There was no significant decrease in our operational funds since 2011/12. Staff salaries are lower in the 2017/18 budget, because one staff line (administrative vacant) has been held vacant to reduce expenses. It is expected that this staff line will be filled in the spring 2018.

Students in the EP program take core courses in physics and in one engineering discipline. Usually, these courses have low enrollment and therefore no additional instructional expenses are needed to offer the EP program. The biggest budget item for EP is the cost of administration as a separate degree program. There is considerable synergy between the physics and EP programs. Only in this combination can a sufficient number of students be reached to offer upper-division physics courses. (10 or more students are usually needed to offer an undergraduate course.) Many EP students also indicate a stronger affinity with physics than with engineering. Therefore, these two degree programs should be housed in the same academic department. Since NMSU is a small institution, the two programs would not be viable as separate programs. (At Cornell University, a much larger institution, Physics and Engineering and Applied Physics are housed in two separate departments.)

**Recurring budget items in the Department of Physics:**

* The Instructional and General (I&G) budget, which consists of State of New Mexico funds, is currently at 1.70 M$ per year (up from 1.59 M$ in the 2011/12 fiscal year). The items in this budget contain the salaries of the Department Head and staff (213 k$, down from 229 k$ in 2011/12 because of an open staff line), the faculty salaries (1087 k$, up from 985 k$ due to pay raises), the graduate teaching assistant salary pools (337 k$, up from 262 k$ because of a benefits accounting change), and departmental operational funds (65 k$, down from 80 k$ in the the 2011/12 fiscal year due to an accounting change).
* Physics faculty members conduct research funded by external agencies (NSF, DoE, Army, Air Force, NASA, etc.) with annual expenditures of approximately 1.7 M$, about 140 k$ per tenured/tenure-track faculty member. These research funds mostly support the research and graduate education mission of the Department. In addition, some of these grants also support undergraduate research, which provide extracurricular learning opportunities for physics and EP undergraduate students. Some grants can be used to purchase equipment, which is available for both research and instructional laboratory use. The undergraduate research funds are supplemented with small grants and scholarships from the New Mexico Space Grant Consortium, the Louis Stokes Alliance for Minority Participation, the NMSU Vice President for Research, and the Colleges of Engineering and Arts and Sciences.
* A portion of the Facilities and Administration (F&A) costs charged to external research grants by the University is returned to the Department. After subtracting the departmental portion of startup commitments and cost share, the department received about 12 k$ in 2016/17. This amount is unusually low because five recent tenure-track faculty hires lead to a large F&A subtraction for the department’s F&A share. This portion of the budget is used to pay a graduate assistant to provide IT support for the department. It also pays for other minor indirect costs, such as automobile insurance or relocation expenses for new hires.
* Finally, the Department of Physics receives about 90 k$ per year in earnings from NMSU Foundation endowed accounts (totaling about 2.5 M$). These funds are used to pay undergraduate student scholarships (scholarships of USD 500 to 3000 for about 20-30 students, totaling 55 k$), hosting physics colloquium speakers, meal and entertainment expenses of candidates interviewing for faculty positions, banquets or picnics for students, faculty, and staff at the end of each semester, named research professorships (Gardiner Professorship), and summer research support for graduate students. A very generous alumnus (career NASA scientist) has donated nearly one million dollars over the past six years to establish a significant scholarship fund for undergraduate students. This donation, along with others solicited by a departmental newsletter and institutional and college-wide appeals, has significantly enhanced the departmental scholarships paid out each year. Since EP is a relatively new program, there is no endowment yet for scholarships in EP, only a very small current use fund. Deserving students in this program must often rely on engineering- or NMSU-wide scholarships or those funded with unrestricted gift funds, since no departmental scholarships are available to students in this program. Dr. Nakotte serves on the College of Engineering scholarship committee and thus can advocate for scholarships to be awarded to students in our program.

The Department of Physics I&G budget is established annually by the institution through the College of Arts and Sciences. Despite recent cuts in state support for the institution and changes in institutional priorities through reallocation of faculty and graduate teaching assistantship lines, the total I&G funds in the Department of Physics have grown by about 7% since 2011/12. See TABLE 8.1 for details. Despite overall budget pressures, the institution has continually supported the Department of Physics, for example by renovating Gardiner Hall, which houses the Department of Physics and the Geological Sciences Department, by hiring a new Academic Department Head, replacing the Administrative Assistant, providing additional funds for two College Professors (teaching faculty), promoting faculty to the next rank, supporting sabbaticals, and by approving a five new junior tenure-track faculty hire since 2011/12. Our undergraduate programs in physics and EP compare favorably in quality, enrollment, and graduation rates with others in the Rio Grande Valley (University of Texas at Brownsville, University of Texas – Pan American, University of Texas at El Paso, New Mexico Institute of Mining and Technology) or in rural West Texas (Texas Tech University, Texas A&M Kingsville, Angelo State University, West Texas A&M University, Abilene Christian University, McMurry University).

**Table 8.1.** Selected annual budget figures of the Department of Physics over the past decade. Estimates are indicated, where precise figures were not available.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Category** | **FY 01/02** | **FY 05/06** | **FY 08/09** | **FY 10/11** | **FY 11/12** | **FY 17/18** |
| ***Operational Funds*** | 76,270 | 76,270 | 80,379 | 80,649 | 80,649 | 65,484 |
| ***Faculty Salaries*** | 992,947 | 1,088,768 | 1,051,328 | 983,859 | 985,159 | 1,087,331 |
| ***Staff Salaries*** | ~250,000 | ~250,000 | 268,566 | 233,345 | 229,067 | 213,741 |
| ***Teaching Assistants*** | 242,607 | 265,728 | 297,401 | 262,413 | 262,413 | 337,485 |
| ***F&A Return*** | 30,499 | 20,000 | ~15,000 | ~15,000 | ~15,000 |  |
| ***Endowments*** | ~60,000 | ~60,000 | ~60,000 | ~60,000 | ~60,000 |  |

Research expenditures and F&A returned to the department vary with the success of physics faculty in obtaining external research support and with the portion collected by the Arts and Sciences Research Center for commitments (faculty start-up or mandatory cost-share). The share returned to the Department of Physics was reduced from 24.5% to 16% in the 2004/05 fiscal year. Earnings from Foundation accounts are based on the 1.5 M$ principal and can vary with the annual return on investments distributed by the Foundation.

In addition to these recurring funds, one-time funds are distributed to the Department of Physics by the institution and by the College of Arts and Sciences.

* The College of Arts & Sciences and the central administration (through enrollment management) provide funds for temporary instructors (including graduate teaching assistants) during the fall and spring semester and over the summer. Salary savings from faculty on one-year sabbaticals, on leave, or from research course buy-outs or joint faculty appointments with federal laboratories are returned to the College of Arts and Sciences. In the 2017/18 fiscal year, the Department of Physics returned 91 k$ to the College of Arts & Sciences as salary savings and received 82 k$ from the College for temporary instructors.
* Each spring, there is a call from the Associate Dean for Academics in Engineering for requests to distribute Student Fees. These funds can be used for equipment, software, maintenance, and supplies. Requests are routed from the Department of Physics through the College of Engineering to a committee of engineering students. Typical allocations to the Department of Physics have been around USD 15,000 per year recently.
* The physics faculty voted not to request approval for additional enrollment-based course fees for our physics laboratory from the central administration, to avoid additional financial burdens for our NMSU students. It seems more prudent to use an engineering-wide fee to pay for technology expenses rather than introducing specific course fees.

Recurring and one-time funds in the College of Engineering are used to pay the salaries of faculty and staff to teach courses in electrical, chemical, mechanical, and aerospace engineering. Similarly, College of Engineering facilities and supplies are used for these courses. College of Engineering faculty members also have had the primary responsibility to teach capstone design courses. With the introduction of an engineering-wide capstone program, capstone design courses in physics may become more common. The College of Engineering also supports EP ambassadors and recruiting and retention of EP students as well as student travel and awards.

*Describe how teaching is supported by the institution in terms of graders, teaching assistants, teaching workshops, etc.*

The University invests approximately $10M annually in Graduate Assistantships for instructional support purposes in the classroom or lab setting to include graders and teaching assistants.

NMSU’s Teaching Academy (https://teaching.nmsu.edu/) provides professional development to NMSU educators. While a variety of programming is provided, the recurring programs include:

* Teaching: evidence-based instructional practices, team-based learning, peer coaching, and classroom observations.
* Leadership: advancing leaders, department head academy, crucial conversation, and strengths finder training.
* Mentoring: team mentoring for faculty, one-on-one faculty mentoring, getting the edge in Academe.
* Scholarship: publish and flourish, writing groups, scholarly writing retreat.
* Career: promotion and tenure programs, new faculty orientation.

NMSU’s Instructional Innovation and Quality (https://instruction.nmsu.edu/) provides support to faculty in delivering education via the non-traditional formats of ITV, blended, and online. This group provides faculty with in-depth professional development and training for best practices in online learning and course consultations ensures quality in blended and online course design, and workshops and consulting on how to effectively utilize the University’s Learning Management System (CANVAS).

The Department of Physics had I&G funds of about 337 k$ for 17.3 half-time equivalent Graduate Teaching Assistants in the 2017/18 fiscal year (fall and spring). Additional teaching assistants are hired from F&A return or one-time funds from the Provost, the Dean of Arts and Sciences, or the Graduate School, bring the total number of teaching assistants during the 2017/18 fiscal year to 19.3. Most of these teaching assistants are assigned to teach two or three general-education laboratory sections. Each semester, the Department of Physics teaches laboratory sections for about 650 students. Each teaching assistant also works in the physics tutoring center for about 2-3 hours per week to assist students with their general-education physics homework. All international students assigned as laboratory instructors have passed the International Teaching Assistant (ITA) screening administered by the Office of the Associate Provost of International and Border Programs. (Students who fail the ITA screening must successfully complete a semester-long 3-credit communication course before they can teach a lab section. To encourage quick academic progress, such students have to enroll in three physics courses and the communication course for a total of 12 credits. The Department of Physics pays 50% of the tuition for the communication course upon successful completion.) These graduate laboratory instructors are trained by the Department of Physics in an orientation session at the beginning of the semester. (The responsibility for hosting this session rests with the Graduate Physics Program Head, Dr. Papavassiliou). Day-to-day supervision for the lab TAs is provided by the Physics lab coordinator, Mr. Carreto-Parra, and by the faculty instructor of record.

International teaching assistants who failed the International TA screening exam (and must be enrolled in the communication course) are usually assigned as graders. Each TA has responsibility to grade for two or three courses, depending on enrollment and workload. In the spring of 2018, 2.5 half-time equivalent graders provided instructional grading support for a total of 8 courses. Since there are not enough graders for all undergraduate courses, some instructors are required to use an online homework system (usually Mastering Physics) in their large lower-division general-education courses.

The Department of Physics also hires undergraduate physics and EP students as learning assistants. They staff our tutoring room and assist with supplemental instruction in the lower-division courses for our physics majors. Sometimes, they also assist with the modern physics laboratory (PHYS 315L) or help to setup laboratory experiments for Mr. Carreto-Parra.

In the summer, general-education courses (PHYS 211G, 212G, and 215G) are usually taught by experienced graduate teaching assistants as lecturers. About four to six first-year graduate students are also hired each summer as laboratory teaching assistants. One of the more demanding summer courses, PHYS 216G, has been taught by a faculty member (Dr. De Antonio or Dr. Nakotte) in recent years.

The institution supports good teaching and the enhancement of instructional skills through a number of on-campus programs, most importantly the Teaching Academy. Tenure-system faculty, College (teaching) faculty, and graduate assistants are all eligible to participate in Teaching Academy workshops free of charge to improve their instructional skills. Many physics faculty participate in Teaching Academy events each year. The College of Arts and Sciences and the College of Engineering encourage their faculty to participate in relevant Teaching Academy events. At least once or twice a year, the Department of Physics also invites established Physics Education Researchers as colloquium speakers to be informed about the latest trends in physics teaching.

Over the last six years, several changes were made to improve the support of teaching assistants and their engagement in the classroom:

* A new permanent instructional lab manager (Mr. Francisco-Parra, MS in Physics from UTEP) was hired. This position was upgraded to require an MS degree. A lab manage with a graduate degree can better related to the graduate teaching assistants in the department. The new lab manager has excellent experimental and practical skills and has
* Sometimes, a first-year teaching assistant is paired with an experienced TA in one lab, allowing the new TA to learn by observing the senior TA.
* Responsibility for the lower-division instructional labs has moved from lab manager to a faculty member as instructor of record. This faculty member will teach one lab section, to be more involved and understand how the labs contribute to student learning in EP. This faculty member is expected to make improvements to at least one laboratory experiment each semester. (For example, new labs on projectile motion and oscilloscope operation were added recently.) The faculty member also chairs the weekly TA meetings on Friday afternoon to prepare for labs during the following week.
* The Department Head now teaches the first-year labs for physics and EP majors (together with a teaching assistant). This allows more one-on-one mentoring of the new students in a semi-formal environment.
* To address some severe cases of cheating, all TAs were trained on how to avoid cheating in instructional lab final exams and how to address cases of academic and non-academic dishonesty. Syllabi were revised to support TAs in their enforcement of academic integrity and classroom management.

*To the extent not described above, describe how resources are provided to acquire, maintain, and upgrade the infrastructures, facilities, and equipment used in the program.*

In addition to the overall budget process listed above, NMSU has various processes in place to provide one-time resources for infrastructure, facilities and equipment. One method, as part of the state appropriations funding, NMSU sets aside funds for Building Renewal & Replacement (BRR) and Equipment Renewal & Replacement (ERR). There is an established process used to consider outstanding requests and allocate funds on a prioritized basis, which is routed for review and approval through the University Budget Committee, the university administration, and the Regents Financial Strategies, Performance and Budget Committee. Available equipment funds (from state appropriations, central funding, and student fee funding) are reviewed and allocated on an annual basis based upon requests from the colleges and departments, which are reviewed and recommended by the University Budget Committee and subsequently approved by the Chancellor. Additionally, available equipment funds are provided annually to colleges and departments based upon an allocation calculation taking into account existing equipment inventory at year end. Besides the routine processes that are in place as described, there are also opportunities for colleges and departments to submit proposals to the university administration for off-cycle funding requests. These requests are evaluated and considered in conjunction with a review of potential funding sources.

In recent years, the Department of Physics and the EP programs have not received BRR and ERR allocations or funds from the other sources mentioned in the preceding paragraph. Given the difficult budget situation, funds to acquire, maintain, and upgrade equipment used by the program must be paid by departmental operations funds, earnings from Foundation endowments, or from student fees, especially the Engineering Technology Fee charged to all students in the College of Engineering.

A two-year renovation of Gardiner Hall (home of the Department of Physics and the Geological Sciences Department) was concluded in the summer of 2010. This renovation included new furniture for faculty offices, classrooms, and student lounges. All classrooms were equipped with a computer, a ceiling-mounted projector, blackboards or white boards, a document camera, a DVD and VCR combo player, and a stereo sound system (standard NMSU smart-room design). One classroom was designed for studio-style and peer-instruction learning based on the latest results from physics education research. This PER classroom is used for supplemental instruction in lower-division courses. Each faculty and staff member received a new computer and printer. The classroom technology components were updated again more recently (around 2015) with high-definition projectors and computers. The key card entry system was replaced in 2017.

EP students have access to the building during evening and weekend hours with key cards. They often meet to study or work on homework problems in the EP student lounge (which is also used as our computational physics classroom a few times a week in the afternoon during the fall semesters). The renovation also provided high-quality space for research laboratories, but no laboratory equipment for instructional or research purposes.

The costs for infrastructure repairs (especially maintenance, supplies, and repairs for computer and audiovisual equipment, furniture, appliances, photocopier and printers) and minor facility improvements (such as new network drops, power outlets for laboratories, theft prevention devices, etc) are paid from the departmental operations budget, except for technology improvements in centrally scheduled classrooms (GN 229, 230, 218A), which are paid centrally by ICT.

*Assess the adequacy of the resources described in this section with respect to the students in the program being able to attain the student outcomes.*

The resources described above are sufficient to meet the meet the stated Program Outcomes and Educational Objectives of the EP program. We have outstanding world-class physicists and engineers as instructors, who are passionate about undergraduate instruction. All physics courses required for graduation are scheduled at least once per year and are taught by a faculty member with a Ph.D. in physics. Occasionally, the College of Arts and Sciences will allow us to teach a course below the minimum enrollment threshold of ten students. (Since physics and EP students are pooled into the same courses, this happens at most once per academic year.) Scheduling conflicts for students are resolved by individual meetings with students outside of the regular classroom hours or by setting up independent-study courses, which are taught by physics faculty as an overload without pay. Physics and engineering courses do not usually fill up. Students are advised as early as possible to find room in required calculus courses during the preregistration period. Therefore, out students can graduate in eight semesters, provided they are ready for calculus in their first semester at NMSU.

While the departmental operating and equipment budgets are small, the resources are sufficient to provide adequate instructional laboratory and computational facilities for our students. Capstone and upper-division laboratory courses are sometimes linked to faculty research projects, which allow us to leverage our significant external research expenditures for EP instruction. Our operational funds are sufficient to hire undergraduate students as learning assistants, to purchase materials and supplies for lower-division general-education laboratories, and for clerical expenses such as photocopies. We also provide a desk and a computer for every graduate and some undergraduate students.

In exit interviews, students generally express satisfaction with our institutional resources dedicated to EP.

## C. Staffing

*Describe the adequacy of the staff (administrative, instructional, and technical) and institutional services provided to the program. Discuss methods used to retain and train staff.*

The Department of Physics currently has ten full-time tenured faculty members, including the Physics Department Head. At present (spring 2018), there are also four tenure-track faculty members. The Physics Department Head teaches one half of the average teaching load for the department, reducing the number of tenured/tenure-track faculty instructors to 13.5 FTE. There are also two half-time College-track (teaching) faculty members. Some faculty members have reduced teaching loads due to research course buy-outs, sabbatical and other leaves, increased service loads, or because they are in the first year of their appointment. Other faculty members whose research productivity has declined have an increased teaching load. When combined, these 14.5 FTE faculty instructors provide adequate teaching, advising, and assessment support for the EP program. Required courses are offered at least once per year and our students can graduate in four years, provided they are ready for calculus in their first semester.

The Department of Physics also has two full-time staff members on campus. Rosa Christensen is the (non-exempt) Administrative Assistant and Fiscal Assistant. Her responsibilities include faculty and student hiring, I-9 forms and E-Verify, student records, student relations, travel arrangements and reimbursements, campus activities, scholarships, and administration of experimental research grants at the departmental level. She also supervises spending of departmental I&G funds. A second Administrative Assistant position is currently open and should be filled in the spring of 2018. Finally, Mr. Carreto-Parra is the (exempt) instructional lab manager. Since the Department of Physics has lost several faculty lines in recent years and because of many research buyouts and bridged faculty positions, we no longer have a sufficient number of faculty members to teach all courses. Therefore, some lower-division general-education courses, including instructional laboratories, are often taught by qualified graduate students with an MS degree in physics on a case-by-case basis.

One great shortcoming that has often been mentioned, especially in reports by our EP Advisory Board, is that this program does not have an administrative assistant specifically for the EP program, Therefore, many clerical and administrative tasks burden the faculty, who therefore have less time for scholarship and supervision of students. Adding a program coordinator is highly desirable, but not likely given the present financial situation in the College of Engineering.

Research faculty and staff members hired entirely for research through external grants and contracts are not mentioned here, since their interaction with the EP program has been minimal over the past five years. Potentially, such research staff might offer an EP capstone design project.

NMSU exempt and non-exempt staff did not have a pay raise since 2012. A 2% pay raise was under consideration of the state legislature in February 2018. The previous pay raise in 2012 was also 2%. (The Administrative Assistant received a reclassification increase of $2000 annually since her duties significantly exceeded the previous job classification.) The lack of raises has made staff morale a challenge. Nevertheless, we have outstanding staff in the Department of Physics. The Department Head supports the staff by promoting a collegial climate in the department. While staff pay is generally low (even for Southern New Mexico), NMSU benefits (medical, dental, retirement, etc) are excellent in comparison with the private sector.

Training for the non-exempt staff members (Administrative Assistant and Fiscal Monitor) on NMSU business procedures (hiring procedures, record retention, general employee safety, etc) is made available by the institution. The instructional lab manager sometimes traveled to the American Physical Society March meeting over the past six years, paid by the Department of Physics operational budget. Such travel allows them to visit lab equipment vendors in the conference exhibit, attend sessions on physics education research, and general physics talks of interest. NMSU also waives tuition for regular employees to enroll in a limited number of courses with permission of the supervisor, which enables employees to continuously improve their skills. The Administrative and Fiscal Assistant currently pursues a Master’s degree in Educational Leadership in the College of Education.

## D. Faculty Hiring and Retention

*Describe the process for hiring of new faculty.*

Faculty lines that become vacant through retirements or resignations are returned to the Office of the Executive Vice President and Provost. Once a year, early in the spring semester, the academic departments submit requests for faculty lines to their college. (The Department of Physics submits such requests to the College of Arts & Sciences.) The colleges collect all requests and submit some of them to the Provost’s Office for approval. Departments are notified during the summer if their line requests have been approved. When the departments request new faculty lines, they also request start-up funds, usually around 190 K$. Typically, the start-up expenses for physics faculty (graduate student support, faculty summer salary, equipment, supplies, and travel) are shared by the Vice President for Research (50%), the College of Arts & Sciences (33%), and the Department of Physics (17%). The Department of Physics share of start-up expenses (17%) consumes most of the F&A (indirect costs) of external research returned to the Department. Vacant faculty lines approved for rehire by the central administration are filled at the Assistant Professor level. The institution budgets new positions at the median of a salary study performed by the institution’s Human Resources department. Recent starting salaries for assistant professors have been around 65 k$, significantly lower than at our peer institutions. Nevertheless, we have been able to make five excellent hires recently.

After the approval for a new faculty line has been received from the Office of the Executive Vice President and Provost through the College of Arts and Sciences, the Department of Physics submits a position request form to the Office of the Provost through the College of Arts and Sciences. Attached to this form are a copy of the proposed ad and a description of the position. The Physics Department Head and the proposed chair of the search committee also meet with the Vice President for Research and the Associate Dean for Research in the College of Arts and Sciences to sign a firm commitment for start-up for the new faculty member. For the most recent hire to start in January 2018, an agreement was reached for a start-up of 190 k$. After the position request form has been fully approved, advertising can begin and a search committee is appointed by the Physics Department Head with concurrence of the Dean of Arts and Sciences. Typically, a search committee will have about 5 members, including one member from a different department and one member from a subfield of physics different from the new faculty member being sought.

The advertisement for the position, approved by Human Resources, is distributed as both a print ad (in Physics Today, typically) and as an online ad (in Physics Today online, and in a variety of jobs databases and email list-servers relevant to the field in question). Applicants are asked to provide a full CV, a statement of research interests, a statement of teaching philosophy, and a list of at least three references. The search committee reviews the applications and selects the best 3-4 candidates for interview. This short list is presented to the Physics Faculty, the Dean, and the Office of Institutional Equity for approval. During the interviews, each candidate will meet with the Dean (or an Associate Dean), the Vice President for Research, and small groups of faculty; present a Colloquium to the whole Department of Physics; teach a lower-division lecture; and present a “pizza seminar” to a group of graduate students – the graduate students make written comments about each candidate. Subsequent to the interviews, the search committee will meet and formulate a set of conclusions about the candidates based on their own experiences in the interviews, informal discussions with other faculty members, and the written comments of the graduate students. These conclusions are presented to a meeting of the Department of Physics faculty, and based on the outcome of that meeting a memo is written to the Dean expressing the conclusions of the Department and describing the strengths and weaknesses of each candidate, without giving a ranked ordering. The Dean then makes the final decision about whom to make an offer.

*Describe strategies used to retain current qualified faculty.*

The department head and college administration strive to sustain a challenging and rewarding professional work environment, so that faculty members remain enthusiastic about remaining with the department. Junior faculty members are provided with opportunities for formal and informal mentoring toward facilitating career success. They are also encouraged to develop areas within departmental academic programs that are of specific interest to them. Numerous professional development courses and workshops are offered on campus at no cost, through the Teaching Academy and the Advance Program, for instance. Faculty and their family members are eligible to take a limited number of NMSU courses free of charge (tuition benefits).

The College of Arts and Sciences also has a comprehensive awards program, including awards to stimulate research and to reward outstanding teaching and service. Such awards are available to junior faculty, tenured faculty, and College Faculty. Details can be found at the NMSU Arts and Sciences web page under the “Faculty & Staff” menu item. Some awards are funds for research (which can include summer salary), course buy-outs, or funds for development such as travel. There are also awards in the Department of Physics (Gardiner Professorship, most recently awarded to Dr. Michael Engelhardt) and from the institution as a whole (such as the Distinguished Achievement Professorship awarded to Dr. Matthias Burkardt). Dr. Ni and Dr. Zollner were recognized by the NMSU President and/or Provost with a Research Discovery Award at a commercial time-out at mid-court at a basketball game. Dr. Pate and the nuclear physics research group and Dr. Zollner were recognized by the Vice President for Research with a research rally. There is also a Regents Professor program at NMSU, but the Physics Department has not had a Regents Professor since 2009.

If a faculty member with a strong record of performance receives an offer from another institution, NMSU will make an effort to retain this faculty member. The faculty member presents a written offer from another institution to the Department Head, who will make a recommendation to the Dean about retaining the faculty member. Retention incentives can include an increase in base salary; retention commitment (similar to start-up commitment) for students, summer salary, travel, equipment, supplies, etc; accommodation of a spouse or partner. The financial burden for such retention incentives is borne entirely by the College of Arts and Sciences. For increases in base salary, the College will typically leave a faculty line vacant and use the funds instead for salary increases to retain qualified faculty members. Retention commitments are paid out of the F&A portion from external research grants paid to the College of Arts and Sciences and the Department of Physics.

It is not yet clear (February 2018) how the 2% pay increase will be distributed among faculty and staff. It is expected that there will be a base adjustment for everybody, with additional increases based on performance. To evaluate faculty performance, the faculty elect two tenured faculty members to consult with the Department Head about performance ratings (exceeds, meets, or does not meet expectations) in the areas of teaching, research, service, and outreach (if applicable). The overall performance rating, once approved by the Dean of the College of Arts and Sciences, will perhaps be considered in determining raises and other reward system elements. For example, in a previous salary increase cycle in 2012, all faculty members with satisfactory performance over the past three years received an across-the-board 1% pay increase. In addition, a 0.85% raise pool was made available to the Department for performance-based raises. The faculty approved a simple formula on how to distribute the additional 0.85% at a faculty meeting. The raises were then implemented by the Department Head, pending approval by the Dean of the College of Arts and Sciences and the Executive Vice President and Provost

## E. Support of Faculty Professional Development

*Describe the adequacy of support for faculty professional development, how such activities such as sabbaticals, travel, workshops, seminars, etc., are planned and supported.*

All tenured faculty members are eligible for sabbaticals as described in NMSU Administrative Rules and Procedures (ARP) Section 8.54. “The purpose of a sabbatical leave is to promote professional growth.” After at least 12 semesters of full-time service, faculty members apply for a sabbatical during the spring semester, requiring approval from the Department Head, the Dean of Arts and Sciences, and the Executive Vice President and Provost. Sabbatical leaves are for one semester at no reduction in salary or for a year at 60% of salary. (The other 40% of salary plus travel expenses are often covered, at least in part, by a host institution visited by the faculty member on sabbatical, such as Los Alamos National Laboratory, University of New Mexico, or Jefferson Laboratory, Sandia National Laboratories, or Fermilab in recent history).

The Department of Physics has a vibrant weekly colloquium speaker series. Typically, about two thirds of colloquium speakers are external. In addition to giving a colloquium about their research, the colloquium speakers also meet individually with faculty and students throughout the day to exchange ideas about topics of common interest (teaching, research, service). Both the colloquium and the individual meetings contribute to faculty development. The speakers often meet with undergraduate students to talk about employment, graduate school, and internship options at their home institution.

Most tenured and tenure-track physics faculty members (all except three) have significant external research grants (in excess of typically 100 k$ per year per faculty member). Their research grants typically contain funds for travel to conferences or other institutions. While primarily for research (and to update faculty knowledge in their area of specialty), conferences such as the general or March meetings of the American Physical Society usually also have sessions contributing to professional development in physics education, which are attended by our faculty members.

The Department of Physics (from its operational I&G funds) and the College of Arts and Sciences provide travel support for College Faculty (i.e., non-tenured lecturers) to attend a regional or national meeting on Physics Education (such as the annual meeting of the American Society of Engineering Education or the American Association of Physics Teachers). Sometimes, such attendance is also supported by the conference organizers. The Department Head and other departmental leaders attend physics leadership conferences, such as the biennial physics department chair conference (organized by APS and AAPT) and meetings intended to increase STEM education and enrollment or physics teacher education. The Department Head shares learning obtained at such conferences and workshops with relevant physics faculty members. New faculty members attend workshops for new faculty organized by AAPT. The EP external advisory board and the Physics external advisory board also provide valuable information, advice, and recommendations to the physics faculty, both in their reports and also in meetings with individual faculty or with groups of faculty.

While NMSU is a minority-serving institution with very limited funds for professional development, there are nevertheless ample opportunities to achieve this aim. Typically, all physics faculty members travel at least once per year, many of them more often. Therefore, institutional support for faculty development appears adequate.

# CRITERION 9. PROGRAM CRITERIA

*Describe how the program satisfies any applicable program criteria. If already covered elsewhere in the self-study report, provide appropriate references.*

The EP program does not have any program-specific criteria.