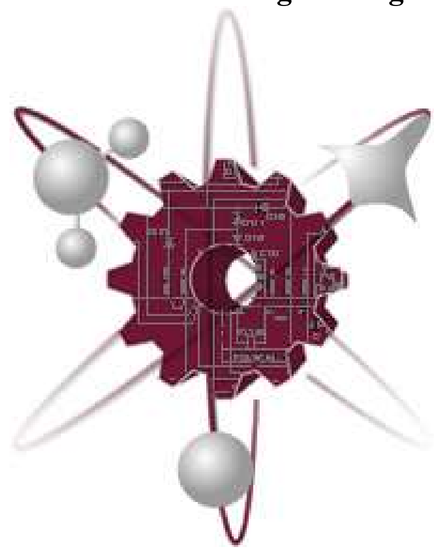
Self-Study Report

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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CONFIDENTIAL

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BACKGROUND INFORMATION

The mission of the *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 positions or to move on to advanced study 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, Ph.D.
Chair of the Engineering Physics Program Committee
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New Mexico State University
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Las Cruces, NM 88003
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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* from the *College of Arts & Sciences* and the *Departments of Mechanical & Aerospace Engineering*, *Chemical & Materials Engineering* and *Electrical & Computer Engineering* all from the *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
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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. *Bachelor of Science (BS)*, *Master 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 of Arts (BA)*, which requires a minor in a second field (popular minors are Astronomy, Chemistry or Mathematics); and later, a *Bachelor 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 focuses 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 a traditional engineering discipline; there were fewer than 20 ABET-accredited *EP Program*s 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 Program*s seeking accreditation since then. EP is generally considered to be one of the most challenging degree programs in academia; however, the potential rewards are very high, as indicated by the *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.*

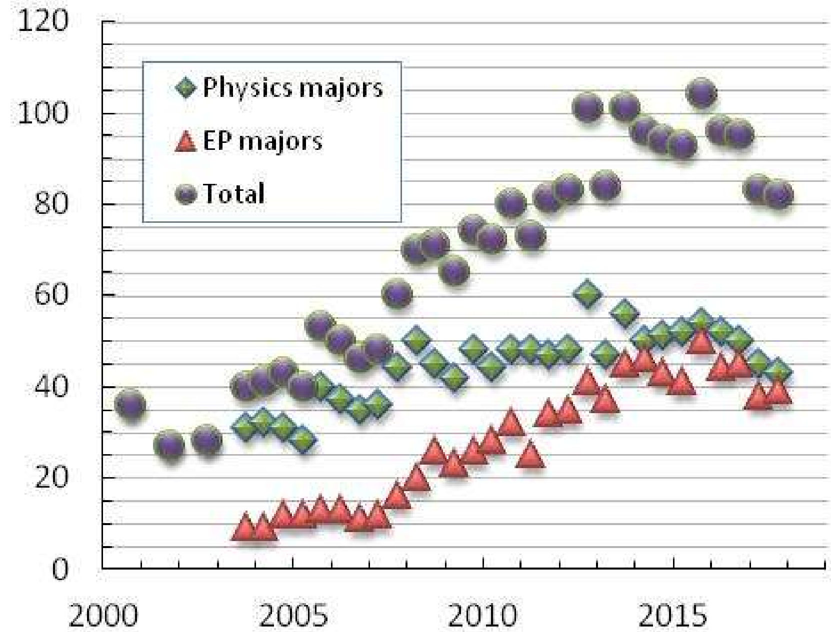


Table 0.1. *Retention and Graduation Statistics for incoming EP freshman since 2008. Students graduating in Spring 2018 are included.*

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	1	5 (62.5%)
Fall 2013	3	1	2		3 (100%)
Fall 2014	5	1			4 (80%)
Fall 2015	14				11 (78.6%)
Fall 2016	9				7 (77.8%)
Fall 2017	4				4 (100%)

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 its academic programs: the *MS* and *PhD in Physics*, the *BS* and *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.

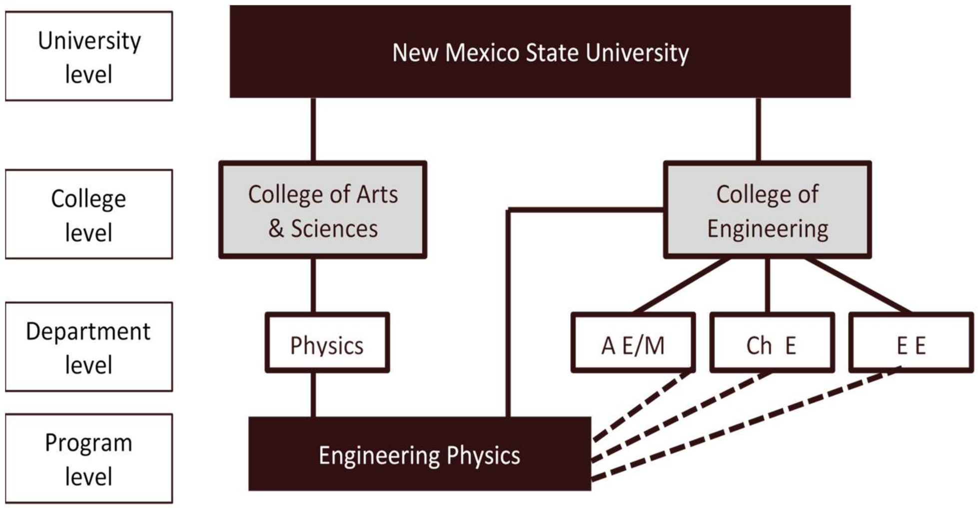
Both colleges benefit from the across-college EP degree. The *College of Engineering* benefits in that the program is fully supported financially through the *Department of Physics* in the *College of Arts & Sciences*. The *College of Arts & Sciences* benefits as the *EP Program* secures sufficient enrollment 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 Program Committee* oversees all program issues, including curricula, program evaluation and growth. 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, *Department of Physics*
Dr. Steve Pate, Professor, *Department of Physics*
Dr. Igor Vasiliev, Professor, *Department of Physics*
Dr. Mike DeAntonio, College Professor, *Department of Physics*
Dr. Fangjun Shu, Associate Professor, Department of Mechanical & Aerospace Engineering
Dr. Steve Stochaj, Professor, Department of Electrical & Computer Engineering
Dr. Hongmei Luo, Associate Professor, Department of 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. 'A E/M' indicates the Department of Aerospace & Mechanical Engineering, 'Ch E' indicates the Department of Chemical & Materials Engineering, 'E E' indicates the Department of Electrical & Computer Engineering.*



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 is an accredited minority-serving institution, and this is also reflected 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, 21 are 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 feasibly 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 *2018-2019 Undergraduate Catalog*, and they are briefly summarized in the following sections.

The *Aerospace Engineering (AE) Concentration* of the *EP Program* requires a total of 133 (or 130 depending on choice of capstone, see discussion below) credit hours, which consist of 15 credits in the *State of New Mexico Common Core Areas IV and V* (GenEd IV/V), 6 credits in *Viewing-the-Wider-World* (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* (ENGR 100), 3 credits in *Civil Engineering*, 15 credits in *Mechanical Engineering*, 24 credits in *Aerospace Engineering*, and 6 credits of an *Engineering Design Capstone*. EP-AE students taking the *Aerospace Engineering Capstone* will have one 3-credit capstone course (130 total credits), those taking the *Engineering-Wide Capstone* will have two 3-credit courses (133 credits).

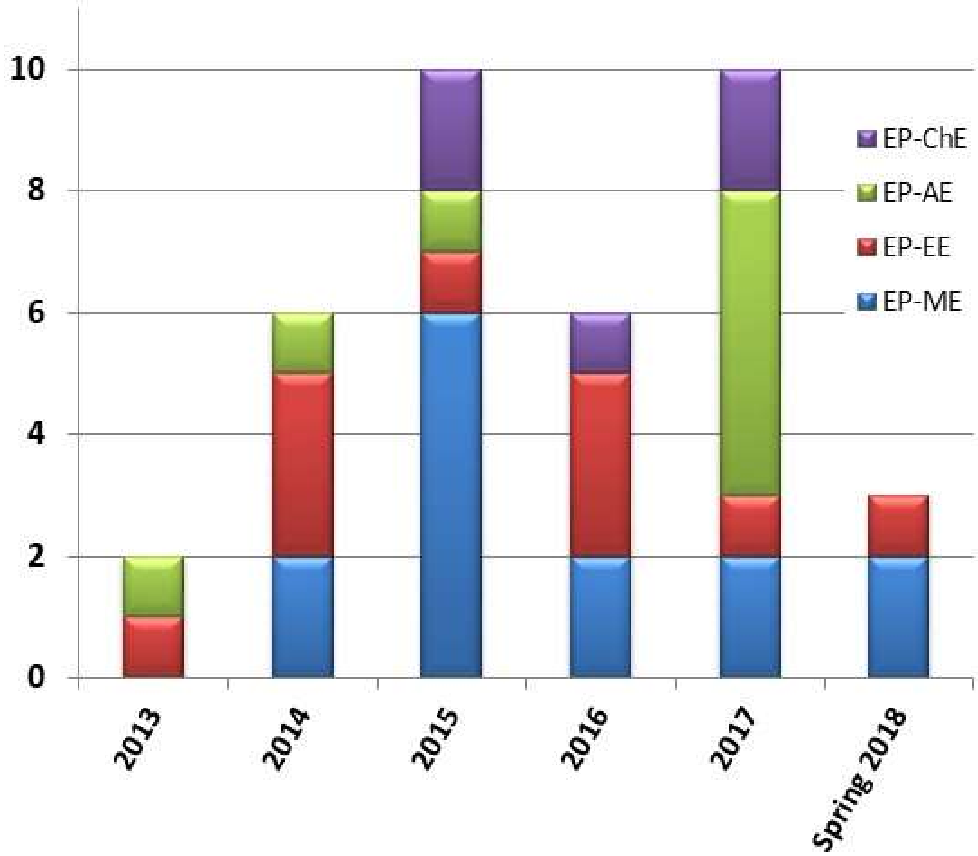
The *Chemical Engineering (CE) Concentration* of the *EP Program* requires a minimum of 132 credit hours, which consist of 15 credits in GenEd IV/V courses, 6 credits in VWW courses, 14 credits in *Mathematics*, 10 credits in *English and Communications*, 11 credits in *Chemistry*, 36 credits in *Physics* (12 of which have significant engineering content), 3 credits in ENGR100, 28 credits in *Chemical Engineering*, 3 credits of a *Technical Elective* (with engineering content), and 6 credits of an *Engineering-Wide Design Capstone*. Alternatively, EP-ChE students can take the 4-credit *Chemical Engineering Capstone*, but it requires another three *Chemical Engineering* courses as pre-requisites (7 additional credits).

The *Electrical Engineering (EE) Concentration* of the *EP Program* requires a total of 129 to 131 credit hours, which consist of 15 credits in GenEd IV/V courses, 6 credits in VWW courses, 14 credits in *Mathematics*, 10 credits in *English and Communications*, 4 credits in *Chemistry*, 42 (or 39) credits in *Physics* (12 or 9 of which have significant engineering content), 3 credits of ENGR100, 27 (or 31) credits in *Electrical Engineering* (where 3 credits of EE 200 count toward the Math contingent), 3 credits of a *Technical Elective* (with engineering content), and 6 credits (two 3-credit courses) of an *Engineering Design Capstone*, to be taken either in *Electrical Engineering* (i.e. the 2-credit cornerstone, EE 300, and the 3-credit capstone, EE402) or *Engineering-Wide* (two 3-credit capstones) In additions EP-EE can opt to take EE 351(4 credits) *to* satisfy the PHYS 462 (3 credits) requirement.

The *Mechanical Engineering (ME) Concentration* of the *EP Program* requires a total of 129 credit hours, which consist of 15 credits in GenEd IV/V courses, 6 credits in VWW courses, 14 credits in *Mathematics*, 10 credits in *English and Communications*, 4 credits in *Chemistry*, 36 (or 33) credits in *Physics* (12 of which have significant engineering content), 3 credits of ENGR100, 3 credits of *Civil Engineering*, 29 (or 32) credits in *Mechanical Engineering*, 3 credits of a *Technical Elective (*with engineering content), and 6 credits of an *Engineering Design Capstone*, to be taken either in the *Mechanical Engineering* or *Engineering-Wide*.

Of the 39 EP students who were 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 from Spring 2013 until Spring 2018. 'EP-ChE' indicates Engineering Physics with the Chemical Concentration, 'EP-AE' indicates an Aerospace Concentration, 'EP-EE' indicates an Electrical Concentration, and 'EP-ME' indicates a Mechanical Concentration.*



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*, courses and laboratories are typically taught using traditional teaching approaches. *Capstone Design* courses require students to be involved in a major design project. In general, the students will work in (sometimes interdisciplinary) teams of 3-5 students. EP students will participate in *Capstone Design Projects* offered through different engineering departments. Participating departments will provide the necessary budget and the space needed to complete a *Capstone Design 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 may be sponsored and are 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 Capstone 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*, and *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 supporting department which offer the course or in large 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 graduation data are made available to the public through the website of *Engineering Physics Program* and/or departmental newsletters.

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 the 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 found later in this document. 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 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 extent 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 the 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 compliant 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 non-refundable 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 transcript(s) sent directly to the *Undergraduate Admissions Office* by the *Registrar* of each college or any post-secondary educational institution previously attended, students may also 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 decision is made.

Freshman Admission Requirements

Students who meet the minimum high school course requirements listed below must meet one of the following criteria 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*

<u>Minimum High School Requirements</u>

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 Algebra I, 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 might 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.

NMSU's admissions website also provides information and 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 the following courses:

Course	Title	Credits
CHEM 111G	*General Chemistry I*	4
or CHEM 115		
ENGL 111G	*Advanced ESL Composition*	4
ENGR 100	*Introduction to Engineering*	3
MATH 191G	*Calculus and Analytic Geometry I*	4
PHYS 213	*Mechanics*	3
or PHYS 215G	*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's *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 prior to admission.

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 the 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 the Undergraduate 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 made 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 on *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 students a letter detailing the consequences should their 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* and/or scholarships (for example, the *NM Lottery Scholarship* requires a minimum of 15 credits). 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 can be re-admitted to the university at the 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 a GPA of 2.0 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 that 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 grade of C or below are required to attend an "intervention session" with their peer mentor. A student who has two C's or grades below are required to see their peer mentor once a week for two weeks, a student with three C's or below is required to see their mentor once a week for three weeks. The program manager conducts 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 were very positive. For example, there was a total of 49 students who were urged to meet with their mentors for an intervention within a few days after risks were identified. Out of the 49 students, 36 met with their mentors 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 met with their mentor two or more times and 92% of those students received a higher final grade, i.e. 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 *Student* Academic Requirements (STAR) 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 and 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. An example of a STAR audit for one of our current EP student (with name and student ID blacked out) is provided in *Appendix E – Supplementary Documentation*.

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. 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 for EP students is the flowcharts for each 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 which course sequence is recommended.

Meeting Pre-requisites

NMSU uses a system called *Banner* for 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 respective departments and submitted to the *Registrar's Office*, where they are entered into the degree-program database. If a student attempts to register for a course for which he/she has not met the pre-requisite requirement(s), *Banner* will reject the registration for the class and notify the student that pre-requisite requirements are not met.

On occasion, the request to waive a pre-requisite is unavoidable and a student will request a waiver for the pre-requisite. For example, it happens that 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 alternatives. If a pre-requisite waiver is indeed necessary, the students or the advisor can petition the instructor to waive pre-requisite requirements for a course.

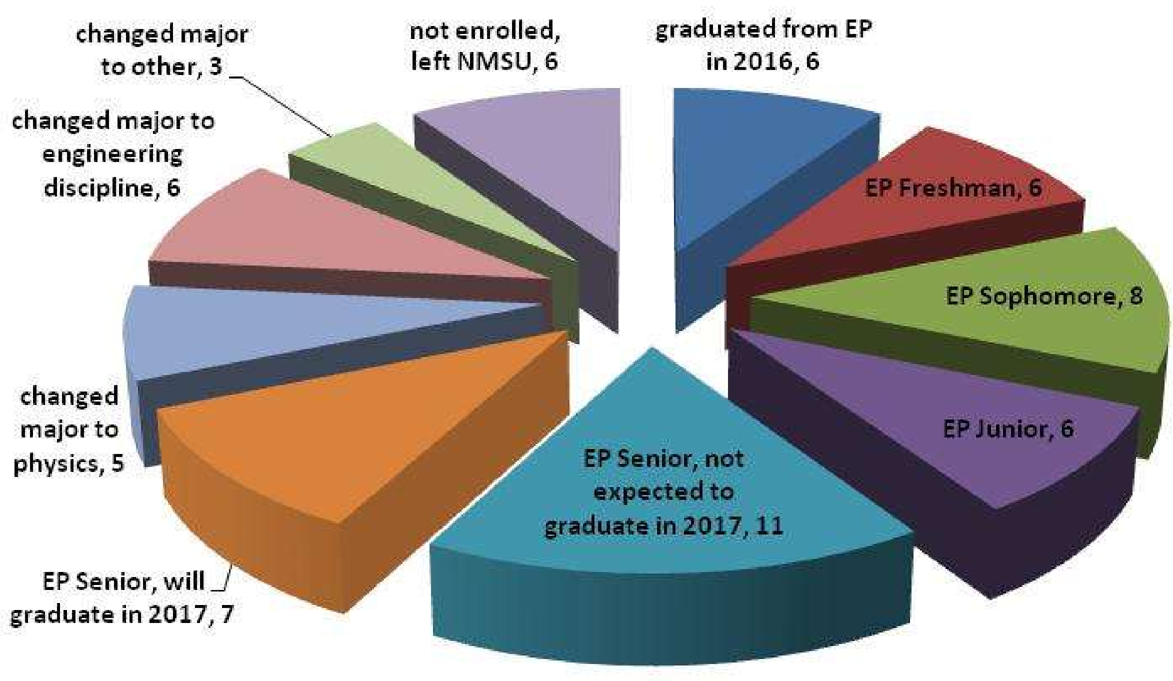
Retention

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* host and support many of their activities. The current *President of* SPS *is* Sean Tierney, and the current *President of* SEPh is Juan Treto. In addition, each society has three faculty advisors (SPS*:* Drs. Cooper, Fohtung and Waszek, SEPh*:* Drs. DeAntonio, Kiefer and Nakotte), at least one of whom participates 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 undergraduate student enrolled in the department, including EP. Students that are 'in trouble' (failing grades, inadequate course enrollments, or similar) are contacted individually by their respective advisors, who discuss with those students how to best approach and correct their individual situation.

The *EP Program Committee* keeps track of previously enrolled EP students 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 an example of retention data prepared for the *Engineering Physics External 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%) either graduated or were still in EP in Spring of 2017.

Diagram 1.1. *Classification and Retention Statistics of EP students between Fall of 2015 and Spring of 2017, as presented to the 2017 Engineering Physics External Advisory Board (EPEAB). The student numbers for each category are provided in the chart.*



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. NMSU requires that 30 of the last 36 credit hours for every degree to be awarded 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 of the last 36 credits be earned through NMSU.

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 form.

Transfer Students- Admission Requirements

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

- Students who have not yet earned credit for the first-semester English course may be required 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 on transfer equivalency 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

This level entails 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

This level entails 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

This level entails 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 the *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 the above conditions, the following conditions apply to any on-line course not taken from the NMSU main campus:

- Scheduled exams, if any, shall be proctored[2].
- 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 proctored exam administered through NMSU Distance Education.

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 currently approximately 40 advisors working on behalf of a college team. Prior to each semester, CAASS places an advising hold into the student's *Banner* accounts to ensure that all students meet with an advisor to make the most educated decisions about upcoming semester course selection and long-term degree planning. Although CAASS oversees all advising activities and the removal of advising holds for students from their freshmen to their senior years, for majors enrolled in small 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. This is the case for our EP curriculum, which vastly differs for the four concentrations and therefore often requires individual course scheduling, course substitutions, and similar. CAASS and the *Department of Physics* therefore agreed to place a departmental advising hold for continuing EP students in good standing, and those students are required to meet with departmental advisors instead (see D.3). All students meet with their academic advisor at least once a semester to stay on track toward completing their academic career and achieving their personal goals while attending NMSU. 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 GPA, student athletes, and students whose GPA is less than that required for their designated major will have an academic advising hold with CAASS. EP students not included in the categories above will have a departmental advising hold with the *Department of Physics* (see D.3).

D.2. *College of Engineering*

The *College of Engineering* does not generally provide any additional formal advising and career guidance for declared engineering majors, in addition to those provided by the CAASS and the departmental programs.

D.3. Engineering Physics (EP) Program

The departmental advising hold prevents continuing EP 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 *Aggie Welcome Orientation* (AWO) for freshmen in the summer before the start of their first semester at NMSU. During the orientation, the students will be given an overview of the university and university life and 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 the 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, departmental 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 one of his/her advisees at the end of each semester for a progress review and advising of the upcoming semester. Advising duties for the *EP Program* are currently shared between Drs. Tom Hearn, Heinz Nakotte and Steve 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 has 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 *Head of the Department of Physics* 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 their signed course request card to the *College of Engineering* in Goddard Hall, Room 106.

EP Advisors keep track of 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

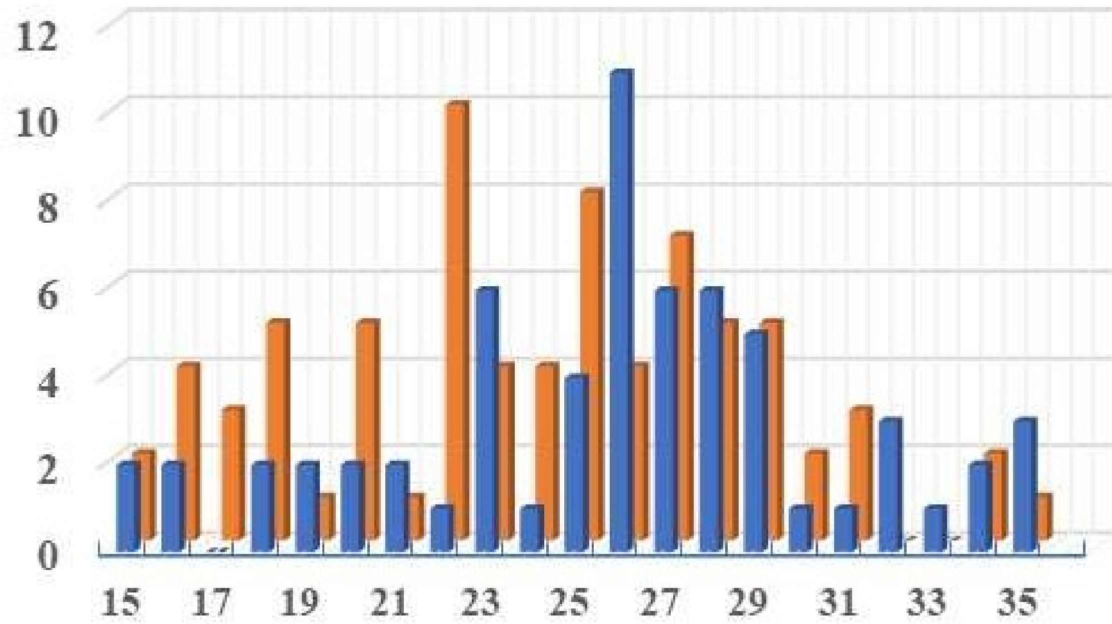
Initial placement in Math and English for all majors at NMSU is determined by a combination of high school GPA and ACT/SAT score, high school AP *Math Course Scores* and/or by performance on the *Math Placement Exam* (MPE) offered by the *Department of Mathematics*. Diagram 1.2 shows the results of a survey of the ACT *Math Scores* for freshman entering the physics and *EP Program* between 2010 and 2015. During that period, the average ACT *Math Score* for physics freshman was 23.9 and for EP 25.8; both of which are well above the average ACT *Math Score* of NMSU incoming freshman overall. This provides an indicator of better than typical math skills of the program's incoming freshman.

Diagram 1.3 shows the *Math & English Placement Grid* used for incoming freshman at NMSU. Between 2010 and 2015, ~62% of EP majors and ~39% of physics majors would have been placed into MATH 191 (Calculus I) or higher, provided their high-school GPA was above 2.75. Students with lower ACT (*or* SAT) *Math Scores* may still place into higher-level math courses, if they passed AP *Calculus* or scored high enough on the MPE during the AWO.

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

Diagram 1.2. ACT *Math Scores of Incoming Freshman in Engineering Physics (blue) and Physics (orange) from 2010 to 2015. The maximum possible score is 36.*



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ACT Math Score

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 be substituted 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.*"

Prospective graduates

EP students who plan to complete graduation requirements at the close of a semester or summer session will typically make an appointment with their academic advisor for a record check. The advisor will check whether all graduation requirements are fulfilled and whether there is a need for substitutions, exceptions, and/or waivers.

Diagram 1.3. *Math and English Placement of Incoming Freshman*

English and Mathematics Placement

Updated June 2016

English Placement

SAT (new) Writing & Language	SAT (old) Verbal	ACT English	English Course
10-19	Below 310	1-12	CCDE 110N/COLL 108 (linked)
20-22	310-399	13-15	CCDE 110N or Integrated CCDE 110N/ENGL 111G
23-31	400-549	16-24	ENGL 111G
32 and above	550-800	25-36	ENGL 111H

Mathematics Placement

			High School GPA							
ACTM	SAT (new)	SAT (old)	[0, 2.5)	[2.5, 2.75)	[2.75, 3)	[3, 3.25)	[3.25, 3.5)	[3.5, 3.75)	[3.75, 4)	>=4
<14	<450	<410	CCDM 105N		0				1	
14-15	450-470	410-430	0	0	1	1	1	1	1	1
16-17	480-500	440-460	1	1	1	1	2	2	2	2
18-19	510-520	470-490	2	2	2	2	2	2	3	3
20-21	530-550	500-520	2	2	3	3	3	3	3	3
22-23	560-570	530-550	3	3	3	3	3	3	4	4
24	580-600	560-580	3	3	4	4	4	4	4	4
25	610	590	4	4	4	4	4	4	4	4
26-36	620	600	4	4	5					

***SAT**: Use new Math score if SAT taken after May 2016. Use old Math score if SAT taken before May 2016.

MPL	Courses
0	CCDM 103N
1	A S 103, CCDM 114N
2	Math 120, Math 210G
3	Math 111, Math 121G, Stat 251G, Stat 271G
4	Math 190G, Math 142G
5	Math 191G, 235

Course Titles

Number	MPL	Title
CCDM 103N	0	Pre-Algebra
A S 103	1	Quantitative Foundations
CCDM 114N	1	Algebra Skills
Math 111	3	Fund of Elementary Math I
Math 120	2	Intermediate Algebra
Math 121G	3	College Algebra
Math 142G	4	Calc for the Biol & Mngt
Math 190G	4	Trig & Pre-Calculus
Math 191G	5	Calculus I
Math 210G	2	Mathematics Appreciation
Math 235	5	Calculus for Tech Student I
Stat 251G	3	Stats for Busi/Behv Sciences
Stat 271G	3	Stats for Psych Sciences

Math Placement Based on MPE

MPL	MPE Score	
0	0-3,-,-,-	Pt. 1 Score
1	4-5,-,-,-	Pt. 1 Score
2*	6,-,-,-	*Note: ACT>=16 required
3*	a,b,-,- a+b>=12	
4*	a,b,c,- a+b+c>=19	
5*	6,6,6,6	

Math Placement Based on AP Calculus Exams

Exam:				
Calc AB	Score 3+	Credit for:	121G&191	6 credits total
Calc BC	Score 3+	Credit for:	191&192	6 credits total

Closed classes

Students can petition with the instructor to be enrolled in a closed section of a course. The *Course 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

Until the 2015 catalog, all EP concentrations required one or more technical elective(s). However, partly because of the introduction of ENGR100 and partly because of curriculum changes in the associated engineering disciplines, currently no technical electives are required for the *EP Aerospace Concentration*, and all other concentrations require just one technical elective. An acceptable technical elective for EP students is a) either a physics course with significant engineering content or b) an engineering course, numbered over 300 or above. 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 from other (non-physics) 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,
- CV (resume) workshops

These and similar activities allow that students learn about career opportunities and how to 'sell themselves 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;
- 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;
- 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 regardless of how 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. The 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 student enrolled with a cumulative GPA of at least 2.0 who is 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: independent study, research or reading courses, 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/she is already registered, he/she 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 members 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* and the *Community College of the Air Force* transcripts. Course equivalencies and credit hours awarded for a NMSU degree are determined by colleges and/or academic departments. Credit hours may be awarded for specific courses toward degree requirements, 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.

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* 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 reapply and pay the appropriate fees. A $25 late fee applies to applications received after the application deadline.

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 *Associate 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 the 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* AP*PM, Section I.E.3.a.)*

Transcripts will be provided at the time when 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 the *Institutional Goals*.

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* (EPEAB, described in more detail in *Part E* of this section), considering the input 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. *Bachelor of Science in Physics* (BS-Physics)*, Bachelor of Arts in Physics* (BA-Physics) *and Bachelor of Science in Engineering Physics* (BS-EP) and two graduate degrees, i.e. *Master 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 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 *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*, 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 aligned with the five NMSU's *Vision 2020 Goals*, as briefly discussed below.

The *EP Objective 1: Competitiveness* is connected of the *Vision 2020 Goals 1: Academics & Graduation*, *3: Research & Creative Activity* and *4: Economic Development & Community Engagement.* Our EP graduates have been proven to be competitive in the job market and are prepared to participate in research and economic endeavors.

The *EP Objective 2: Adaptability* supports the *Vision 2020 Goals 2: Diversity & Internationalization*, *3: Research & Creative Activity*, *4: Economic Development & Community Engagement* and *5: Resource Stewardship.* Our *EP Program* thrives to train graduates to work in multi-disciplinary and often multi-cultural teams with sometimes limited resources. Graduates learn that they must occasionally adapt, learn new skills, and acquire additional expertise to address unfamiliar challenges.

The *EP Objective 3: Teamwork & Leadership* is connected to the *Vision 2020 Goals 2: Diversity & Internationalization*, *3: Research & Creative Activity* and *4: Economic Development & Community Engagement*. Almost all successful research or economic endeavors require teamwork and/or leadership skills, and such skills must extend to populations with diverse backgrounds, given the largely global economy nowadays.

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 *EP Program*.

EP students

Students provide feedback to the program through mandatory student evaluations of each course taken, during advising sessions with the EP advisor and Senior-Student Exit Interviews with the *Department Head*. EP students also meet with the *Engineering Physics External Advisory Board* (EPEAB) during their site visit, at which time they can formulate any concerns or suggestions related to the *EP Program* to the EPEAB, with no NMSU faculty or administrators present.

Potential Employers *(Industry, Academia, Government)*

This is an important constituency group, and it is strongly represented on our EPEAB; for membership, see Table 2.4. 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 EPEAB, 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 *Engineering Physics (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* tries to keep an updated list of its alumni, their current contact information, their current employment status and 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 ABET. A few examples of ABET-accredited *EP Programs* are *Colorado School of Mines*, *South East Missouri State University*, *Tulane University*, *University of Oklahoma* and *University of Maine*. The *Department Head of the EP Program* from *South East Missouri State University* serves as a member on our EPEAB and he is a certified ABET evaluator; we therefore built on his 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 of the *State of 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 improvement of our *EP Program*. Input from our constituencies is included in the assessment of the program and we solicit their assistance for further developing our program. Moreover, many of our constituencies serve as members of the EPEAB (see Tables 2.3 and 2.4). 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 dynamic and continuing process. If needed, adjustments and improvements to the *Educational Objectives* are initiated by *the EP Program Committee*, which suggests changes and/or modifications to the objectives, if needed. The processes and procedures for establishing, publishing and evaluating the *Program Educational Objectives* are briefly described in the sections below.

The *Engineering Physics (EP) Program Committee* is the main body in charge for the following aspects related to the *Program Educational Objectives*:

- formulate *Program Educational Objectives* and revise them, if needed;
- periodically evaluate the achievement of *Program Educational Objectives*, and make suggest changes to program delivery and/or content, if needed; and
- publish *Program Educational Objectives* and data related to their achievement.

As mentioned above, our *Program Educational Objectives* were revised in 2012, just prior to the previous ABET accreditation cycle, and in close collaboration with the 2012 *Engineering Physics External Advisory Board* (EPEAB). Our *Educational Objectives* are formulated such that they follow the ABET guidelines, and show consistence with the institutional goals and the needs of the program constituents, particularly potential employers and graduate schools. The EPEAB and the *EP Program Committee* discuss and review the continued adequacy of our *Program Educational Objectives* during the EPEAB site visit (see below).

The main body in charge of evaluating whether the *EP Program* is successful in achieving its *Educational Objectives* is the EPEAB, which meets every 1-2 years with the *EP Program* representatives at NMSU. The *EP Program Committee* prepares updated materials and data in support of whether the *EP Program* achieves its *Educational Objectives* to the EPEAB prior to site visit. Aside from EPEAB input, the *EP Program Committee* tries to stay in touch with the program's alumni, either through voluntary *Alumni Surveys*, connections through *LinkedIn* or similar professional networks, and/or personal contacts. We have contact information for more than 80% of our alumni, a significant fraction of whom provide information and data connected to our *Program Educational Objectives*. Those data are collected and updated (if needed) in the documents and/or spreadsheets that are kept in a *OneDrive* folder dedicated to the *EP Program*. In addition, the *Engineering Physics Program Committee* occasionally seeks informal feedback from other constituents, such as employers of our EP alumni and faculty and administrators involved in the program. Data and informal feedback pertaining to the achievement of *Program Educational Objectives* are discussed in the *EP Program Committee*, which meets regularly each semester (at least monthly, but up to weekly when, for example, changes to the program are required or an EPEAB meeting is upcoming). The *EP Program Committee* formulates recommendations for program improvement for consideration by the physics faculty, and recommendations may lead to changes or modifications in program delivery, assessment, and approaches, some of which are discussed in *Criterion 4 – Continuous Improvement*.

The *Program Educational Objectives* for the *EP Program* are posted near the main office of the *Department of Physics*, and they are prominently displayed on the homepage of program's website. Data related to its achievement of the *Program Educational Objectives* are periodically updated on the program's website (about once a year). Moreover, alumni information is often included in presentations, fliers, brochures and newsletters, prepared for recruitment and/or outreach purposes.

The EPEAB plays an instrumental role for the overall program evaluation and assessment of achieving its *Educational Objectives*. The EPEAB has four standing tasks: 1) review current policies and procedures within the program, 2) identify potential issues and areas of concern, 3) evaluate whether the program achieves its stated *Educational Objectives*, and 4) prepare a report for distribution to the *EP Program Committee* and the *Deans*. 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

After the 2016 EPEAB site visit, 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 from academia). The current members of the EPEAB are listed in Table 2.4.

Table 2.4. *Current Members Engineering Physics External Advisory Board (EPEAB).*

2017 and 2018 Engineering Physics External Advisory Board (EPEAB)
2017 On-Campus Visit: April 28 & 29, 2017
2018 On-Campus Visit: April 28 & 29, 2018

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 representative examples of data presented to the EPEAB during their site visit.

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.

Following the 2012 ABET accreditation, the EPEAB assessment of achievement of our *Program Educational Objectives* has remained very positive, as evidenced by their written report. Excerpts from the 2014, 2016, 2017 and 2018 EPEAB reports are provided below.

The 2014 EPEAB report stated:

The Engineering Physics (EP) degree program, about to begin its fourteenth year, has developed into a successful, accredited, and growing component of the physics and engineering departments at New Mexico State University. The Engineering Physics Program is challenging, and as a result, attracts some of the best and brightest students at the University. Along with high caliber students, the Physics Department faculty members are a major strength of the program, exhibiting a dedication to both program excellence and student achievement. Program objectives, in terms of graduate competitiveness, adaptability, and teamwork and leadership skill, continue to address the curricular interests of the students, while reflecting the needs and desires of the constituencies being served by the program. Graduates of the program have demonstrated success at finding employment within industry and laboratory settings, or moving on to advanced study in physics or engineering.

The 2016 EPEAB report stated:

The variety of data and metrics reviewed all point to a very successful EP Program. The Committee was presented with many good examples of student academic successes and student's abilities to find employment in scientific or technical organizations. In addition, several recent graduates are moving forward with plans for an advanced degree at very respectable scientific or engineering schools. General performance data based on standardized testing shows a skewed distribution where roughly the top 10 percent rank nationally in physics comprehension.
In addition to the program specific educational objectives discussed below, The EP Program contributes towards the broader objectives of NMSU.
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 graduates of the program proving competitive in graduate-level academic, government, and industrial environments. EP Program graduation rates are increasing, with career choices for graduating EP students more diverse than physics department graduates2.
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. These not only meet the goals of the program, but of the broader university, and with greater economic impact.

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

Preparation for leadership of interdisciplinary teams is a commonly neglected element of focused engineering and science programs, but simultaneously among the most needed skills leading to the success of large engineering and science projects. EP Program graduates are well-prepared to bridge this project integration gap. During the previous review, it was noted that 23% of program graduates list supervisory duties and 92% report working in team environments.

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 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.*

The 2018 EPEAB meeting was mostly dedicated to reviewing the draft of this Self Study Report; however, the board also provided feedback with respect the *Program Educational Objectives* by stating:

The EP Program has three educational Objectives:
<u>*EP Objective 1: Competitiveness. Graduates are competitive in internationally recognized academic, government, and industrial environments*</u>
The EP Program continues to mold and shape its students into capable performers; approximately one-third of EP Program graduates go on to pursue graduate-level studies, while the remainder enter government-related or industrial careers, or engage in business opportunities. The Program maintains good contact with graduates, having regular correspondence with 50 of the 58 past graduates. Unemployment in science and engineering fields is generally very low, with high starting salaries. EP Program graduation rates have been trending, with enrollment indicating good retention (with the exception of 2017). Career choices for graduating EP students are more diverse than for either physics or engineering graduates1.
<u>*EP Objective 2: Adaptability. Graduates exhibit success in solving complex technical problems in a broad range of disciplines subject to quality engineering processes.*</u>
EP Program graduates are entering advanced programs of graduate 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 great 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.
<u>*EP Objective 3: Teamwork and Leadership. Graduates have a proven ability to function as part of and/or lead interdisciplinary teams.*</u>
Preparation for leadership of interdisciplinary teams is a generally neglected element of university curricula for engineering and science majors. 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 environment

Diagram 2.3. *Career Choices of NMSU EP Alumni (data from Summer 2018). Career choices are separated into broad categories shown by capital letters, individual choices are given in brackets and total number of all EP alumni for each of the career categories are provided at the end. The individual career choices list the last known affiliations of the alumni.*

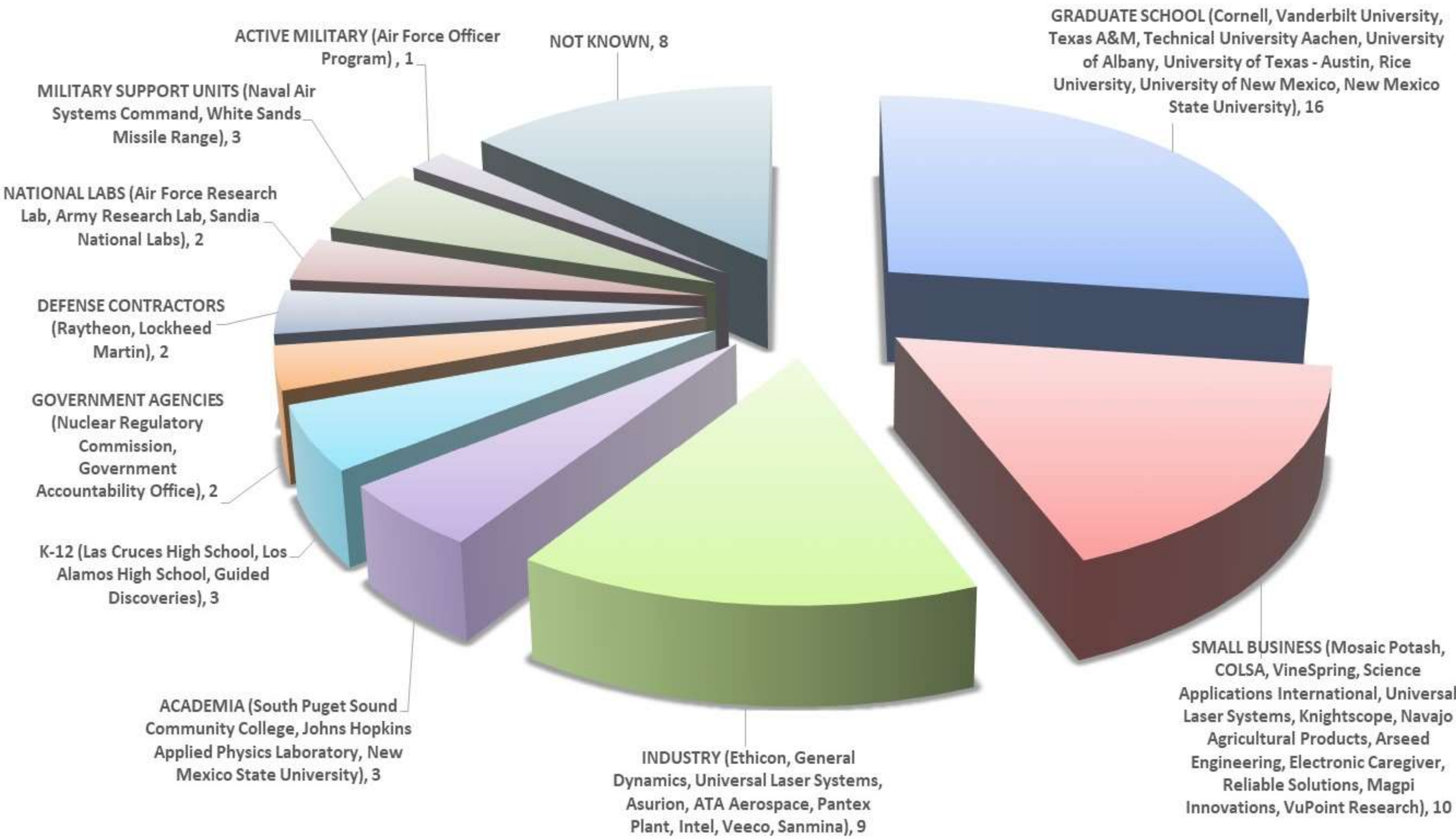
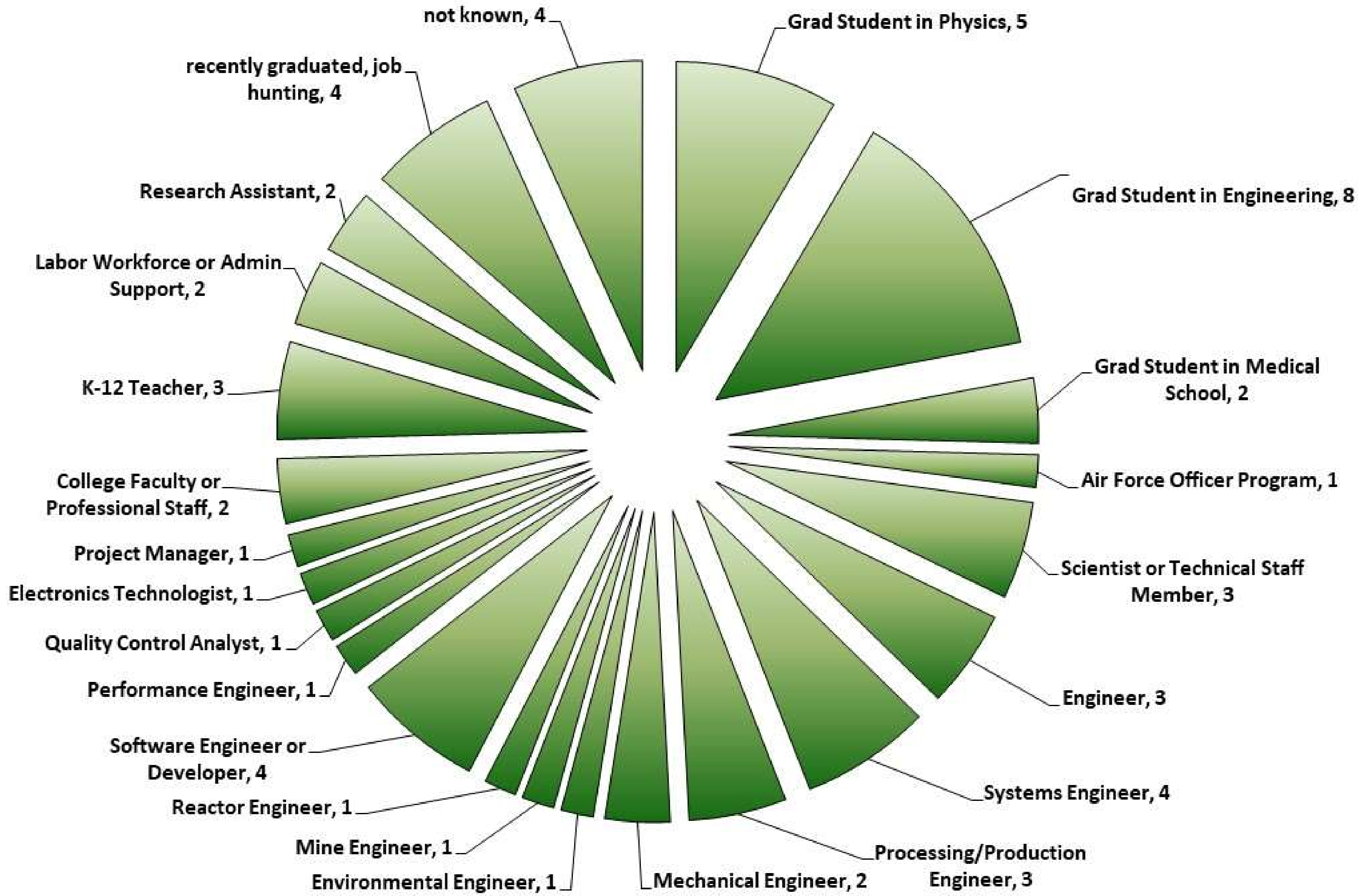


Diagram 2.4. *Last known Job Titles of NMSU EP Alumni (data from Summer 2018).*



Aside from the *Engineering Physics External Advisory Board* (EPEAB), the *Department of Physics* has a separate *Physics External Advisory Board* (EAB), which meets annually every fall semester. The EAB looks at the department as whole and reviews all physics programs, undergraduate and graduate, offered in the *Department of Physics*. Their review is not limited to a particular degree program, such as the EP undergraduate program, and the EAB provide a more focused evaluation of research strength and opportunities as well as graduate education. The current members of the *Physics External Advisory Board* are provided in Table 2.5.

Table 2.5. *Current Members Physics External Advisory Board (EAB).*

2017 Physics External Advisory Board (EAB)
On-Campus Visit: November 10 & 11, 2017
Prof. Nina Abramzon
Professor in Physics
California State Polytechnic Institute, Pomona CA
Dr. Richard Carreras
Division Deputy Technical Advisor
Air Force Research Laboratory, Albuquerque NM
Dr. Benjamin Gibson
Scientist 4, Theory Division
Los Alamos National Laboratory, Los Alamos NM
Dr. Mary Hockaday
Associate Director, ADEPS Division
Los Alamos National Laboratory, Los Alamos NM
Dr. Mark Holtz (Co-Chair)
Department Head, Physics
Texas State University, San Marcos TX
Dr. Alan Hurd
NSEC/NMC Executive Advisor
Los Alamos National Laboratory, Los Alamos NM
Dr. Andrea Palounek (Co-Chair)
Physicist and Secretary of the Four-Corners Section of the American Physical Society
Los Alamos National Laboratory
Dr. Leon Radziemski
Owner
Piezo Energy Technologies LLC, Tuscon AZ
Prof. Joseph Shinar
Department of Physics & Astronomy
Iowa State University, Ames IA
Dr. Michael Valley
Senior Manager, Materials Science R&D Group Materials Science and Engineering Center Sandia National Laboratories, Albuquerque NM

On occasion, the EAB reports comment on the processes and procedures that were specifically implemented for the *EP Program*. For example, the 2016 EAB report recommended:

Tracking of Engineering Physics (EP) students is very good. The efforts of [the Engineering Physics Program Chair] are appreciated, and present a model to follow. The Accreditation Board for Engineering and Technology (ABET) of that program requires that EP graduates be tracked after graduation. With this effort in place, tracking should be extended to all Physics undergraduate and graduate students.

Aside from feedback from both advisory boards, 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*.

Table 2.5. *Results of the 2014 and 2017 alumni response to survey questions whether the NMSU EP Program achieved its stated 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			

All materials connected to the *Educational Objectives* of the *EP Program* are compiled in the so-called *'Black' Educational Objectives Notebooks* ('black' refers to the color of the notebooks). The contents of the *'Black' Notebooks* are listed in *Appendix E – Supplementary Documents*.

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. Above engineering programs, including EP, are currently ABET accredited and all of them are preparing for re-accreditation in 2018. Each of the engineering 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. The *EP Program* has little influence on assessment procedures formulated by other engineering programs, which were established such that they were adequate for their own majors. However, this is not the case for physics courses that are under full control of the *Department of Physics.* Therefore, the *EP Program* formulated a separate own *Program Outcomes & Assessment Procedure* using physics courses and other measures under the control of the department.

It should be noted, however, that curricular changes (e.g. changes in the course sequence, delivery and content) by participating engineering departments may affect the *EP Program* as well. This is one 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 provide the benefit of multiple independent and complementary measurements for each *Program Outcome*.

After consultation with the *Deans of the College of Engineering*, faculty members from 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)* suffice to ensure the quality of our *EP Program*. An additional advantage is that these outcomes are common to all engineering programs, making the cross-departmental and cross-college *EP Assessment* more straightforward. Subsequently, we continue to adopt the *ABET Program Outcomes (a)-(k)*, with some minor addition in the *Program Outcomes (e)*, *(h)* and *(k)*, where we specifically add the word *physics* into the phrasing. The *EP Program Outcomes* are listed in Table 3.1., and each of the *Program Outcomes* was named with an identifying acronym for future reference. These *Program Outcomes* are posted in near the main office of the *Department of Physics* and displayed on the *EP Program*'s website.

Table 3.1. *Engineering Physics (EP) Program Outcomes (a)-(k).*

(a)	**Scientific Expertise:** an ability to apply knowledge of mathematics, science, and engineering.
(b)	**Experimental Training:** an ability to design and conduct experiments, as well as to analyze and interpret data.
(c)	**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.
(d)	**Teamwork:** an ability to function on multi-disciplinary teams.
(e)	**Problem Solving:** an ability to identify, formulate, and solve engineering and physics problems.
(f)	**Professional Responsibility:** an understanding of professional and ethical responsibility.
(g)	**Communication Skills:** an ability to communicate effectively.
(h)	**Societal Impact:** the broad education necessary to understand the impact of engineering and physics solutions in a global, economic, environmental, and societal context.
(i)	**Life-long Learning:** a recognition of the need for and an ability to engage in life-long learning.
(j)	**Contemporary Issues:** a knowledge of contemporary issues.
(k)	**Technical Know-How:** an ability to use the techniques, skills, and modern engineering tools necessary for engineering physics practice.

Like for most other engineering programs, *EP Program Outcomes Assessment* is predominantly done *via* measurements in individual courses. The *EP Program Committee* assigned one or more outcomes measures to each physics course that is part of the EP curriculum. 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 recent years by selecting additional courses for assessing *Program Outcomes (f)*, *(h)*, *(i)* and *(j)*, which are commonly considered as the more 'difficult' outcomes to assess. This change was needed because all *EP Concentrations* had to reduce the number of elective courses needed for graduation because of curricular pressure elsewhere, such as the addition of an ENGR 100 course for all engineering courses. Prior to that change, *Program Outcomes (f)*, *(h)*, *(i)* and *(j)* were assessed only in physics electives and the required PHYS 315 course. The reduction of electives left gaps in the measurements for those *Program Outcomes*, and the gap was filled by selecting additional core physics courses for assessment of such outcome.

Course *Program Outcomes* Assessment

The *Department of Physics* has 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 other 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*.

The *Department of Physics* uses a senior-level test from the *Educational Testing Service® (ETS) - the Physics Major Field Test* (MFT). The MFT 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.* The MFT is not mandatory, but every EP student has an opportunity to take the test at least once. The MFT is a commercially-produced test that is widely used by 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 MFT consists of two parts: the first one is on *Introductory Physics* and the second part is on *Advanced Physics* topics. Results on the first part are used for measurement of achievement of *Program Outcome (a) - Scientific Expertise* and results of the second part are used for *Program Outcome (e) - Problem solving*. Furthermore, we use the percentage participation of students in the MFT as an indicator of achievement of *Program Outcome (i) – Life-Long Learning*, since the test is voluntary.

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 (PHYS 213 or PHYS 215G), but we have also given it as part of the upper-division physics course on mechanics (PHYS 451). Freshman students are typically below the *entry level* but should be past that level 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 had Dr. Steve Kanim as one of its faculty members. While Dr. Kanim is now retired, he continues his research in *Physics Education*

Research (PER). He helped develop 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 PHYS 215GL, the introductory mechanics labs in physics. These labs make it possible to evaluate student performance 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 PHYS 216GL 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-requisite materials needed for taking a course. While most pre-requisite tests 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 an indicator if *Program Outcomes* are met.

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

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*.

The current *EP Outcomes Assessment Matrix* is provided in Table 3.2.a. The table includes the assessment assignments for required physics courses, approved technical physics electives, some other electives and non-course measures. Some rows contain two alternative courses, e.g. PHYS 213 or PHYS 215G, where both measure the same *Program Outcome(s)*. The curriculum of our *EP Program* and the individual course contents have been designed such that there are multiple measures for each of the *Program Outcomes*. The last row after each category indicates how often each *Program Outcome* is measured for an EP student throughout program completion.

Table 3.2.a. *Current EP Outcomes Assessment Matrix for Program Outcomes (a)-(k).*

Required Physics or Capstone Course for all EP majors	***Program Outcome***										
	(a)	***(b)***	***(c)***	***(d)***	***(e)***	***(f)***	***(g)***	***(h)***	***(i)***	***(j)***	***(k)***
PHYS 213 or 215G Mechanics	X										
PHYS 213L or 215GL Mechanics Lab		X									
PHYS 214 or 216G Electricity & Magnetism	X										
PHYS 214L or 216GL Electricity and Magnetism Lab		X									
PHYS 217 Heat, Light, & Sound	X										
PHYS 217L Heat, Light, & Sound Lab		X	X	X			X				
PHYS 315 Modern Physics	X					X		X	X	X	
PHYS 315L Modern Physics Lab		X	X	X		X	X				X
PHYS 395 Intermediate Mathematical Methods for Physics											X
PHYS 454 Intermediate Modern Physics I					X						
PHYS 455 Intermediate Modern Physics II					X						
PHYS 461 Int. Electricity & Magnetism I					X	X		X	X	X	
Number of times an outcome is measured in required physics and capstone courses	*4*	*4*	*2*	*2*	*3*	*3*	*2*	*2*	*2*	*2*	*2*
Required Physics Course for some EP Concentrations (indicated in brackets)	***Program Outcome***										
	(a)	***(b)***	***(c)***	***(d)***	***(e)***	***(f)***	***(g)***	***(h)***	***(i)***	***(j)***	***(k)***
PHYS 451 (CHE, EE) Intermediate Mechanics					X	X		X	X	X	
PHYS 462 (AE, CHE, ME) Int. Electricity & Magnetism II					X	a		a	a	a	
PHYS 480 (EE) Thermodynamics					X	a		a	a	a	
Total number of times an outcome is measured for any EP student in required courses	***4***	***4***	***2***	***2***	***4-5***	***2-4***	***2***	***2-4***	***2-4***	***2-4***	***3***

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

Table 3.2.a. *- continued*

Technical Physics Electives	***Program Outcome***										
	(a)	***(b)***	***(c)***	***(d)***	***(e)***	***(f)***	***(g)***	***(h)***	***(i)***	***(j)***	***(k)***
PHYS 468 Intermediate X-Ray Diffraction		X		X		X	X				X
PHYS 471 Modern Experimental Optics		X	X	X		X	X		X		X
PHYS 475 Advanced Physics Laboratory		X	X	X		X	X				X
PHYS 476 Computational Physics			X								X
Physics 488 Intro to Condensed Matter Physics					X	X		X	X	X	
Physics 489 Introduction to Modern Materials					X	X		X	X	X	
PHYS 493 Experimental Nuclear Physics		X	a	X		a	X				X
PHYS 495 Mathematical Methods of Physics											X
Number of times an outcome is measured in a technical elective		***0-1***	***0-1***	***0-1***	***0-1***	***0-1***	***0-1***	***0-1***	***0-1***	***0-1***	***0-1***

Non-Technical Physics Electives	***Program Outcome***										
	(a)	***(b)***	***(c)***	***(d)***	***(e)***	***(f)***	***(g)***	***(h)***	***(i)***	***(j)***	***(k)***
PHYS 303V Energy and Society	a	a		a		a	a	a	a	a	
PHYS 305V Water in the Solar System	a	a		a		a	a	a	a	a	

Non-Course Outcomes Measures	***Program Outcome***										
	(a)	***(b)***	***(c)***	***(d)***	***(e)***	***(f)***	***(g)***	***(h)***	***(i)***	***(j)***	***(k)***
Senior-Student Exit Interviews	X	X	X	X	X	X	X	X	X	X	X
MFT Test	X				X	X					
Number of times an outcome is measured outside of a course	***2***	***1***	***1***	***1***	***2***	***2***	***1***	***1***	***1***	***1***	***1***

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

A few faculty members in the *Department of Physics* pointed 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 have carried 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, i.e. changing from *(a)-(k)* to *(1)-(6)*, in the coming year.

Like the *EP Outcomes Matrix* used by the *Department of Physics* for assessing the *EP Program*, the *Course Outcomes Matrices* of participating engineering departments have undergone some changes since their last accreditation cycle due to changes is their respective curricula. Courses taught in participating engineering programs have been assigned to measure one or more of the *Program Outcomes (a)-(k)*, and many of those courses are required for the EP curriculum, depending on the *Concentration*, i.e. *Aerospace (AE), Chemical (CHE), Electrical (EE) or Mechanical (ME) Engineering.*

The *Course Program Assessment Matrix* for required ME and AE courses for EP-AE students are given in Tables 3.2.b; the one for required CHME courses for EP-CHE students is given in Table 3.2.c, the one for required EE courses for EP-EE students is given in Table 3.2.d, and the one for EP-ME students is given in Table 3.2.e. Moreover, all EP students are required to take the ENGR 100 course and EP majors with the AE or ME concentration are required to take CE 301 with outcomes assessment assignments as shown in Table 3.2.f. The separate outcomes assessment in engineering ensures the program quality and delivery for the engineering portions of our *EP Program*. The engineering departments typically have also additional program-specific outcomes, but those are not part of our *EP Program.* 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 one of those *Program Outcomes* independently (although it typically covers most of them) for every single EP student.

The *EP Program* requires supporting courses in MATH, CHEM and ENGL/COMM and there are also additional *General Education* and *Viewing-the-Wider World* requirements for their majors (see *Criterion 5- Curriculum*), and none of those courses is currently required to provide some assessment to the *ABET Program Outcomes (a)-(k)*, although they may have defined their own outcomes. In all cases, these courses meet the university's general accreditation criteria, which are aligned with the requirements of the *Higher Learning Commission* (HLC) of the *North Central Association of Colleges and Schools* (NCA); see *Appendix D – Institutional Summary*.

Table 3.2.b. *Current Aerospace-Engineering Course Assessment Matrix for Program Outcomes (a)-(k). Only required courses for EP majors with the Aerospace Concentration are included. For EP-AE students, Program Outcomes (f), (h), (i) and (j) are not separately measured in ME or AE courses required for their major.*

Required Mechanical or Aerospace Engineering Course for EP-AE majors	***Program Outcome***										
	(a)	***(b)***	***(c)***	***(d)***	***(e)***	***(f)***	***(g)***	***(h)***	***(i)***	***(j)***	***(k)***
ME 236 Engineering Mechanics I	X				X						X
ME 237 Engineering Mechanics II					X						
ME 240 Thermodynamics					X						
ME 261 Mechanical Engineering Problem Solving	X				X						X
ME 345 Experimental Methods I		X					X				X
AE 339 Aerodynamics I	X	X	X		X						
AE 362 Orbital Mechanics	X				X						X
AE 363 Aerospace Structures	X				X						X
AE 364 Flight Dynamics Control	X				X						X
AE 419 Propulsion	X				X						X
AE 424 Aero Systems Engineering			X	X			X				
AE 439 Aerodynamics II	X				X						X
AE 447 Aero Fluids Laboratory	X	X			X		X				
Number of times an outcome is measured in required ME and AE courses for EP-AE majors.	***9***	***3***	***2***	***1***	***11***		***3***				***8***

The methods used to assess the assigned *Program Outcomes* in courses and the ways on how measurements are enforced are under the control of the *Department of Mechanical & Aerospace Engineering*.

For a discussion of changes in the *EP Curriculum* with the *Aerospace Concentration* compared to the 2012 catalog, see *Criterion 5 – Curriculum*.

Table 3.2.c. *Current Chemical-Engineering Course Assessment Matrix for Program Outcomes (a)-(k). Only required courses for EP majors with the Chemical Concentration are included.*

Required Chemical Engineering Course for EP-CHE majors	***Program Outcome***										
	(a)	***(b)***	***(c)***	***(d)***	***(e)***	***(f)***	***(g)***	***(h)***	***(i)***	***(j)***	***(k)***
CHME 101 Introduction to Chemical Engineering Calculations	X			X	X	X	X		X	X	X
CHME 102 Material Balances	X			X	X	X	X				X
CHME 201 Energy Balances and Basic Thermodynamics	X	X			X						X
CHME 303 Chemical Engineering Thermodynamics	X	X		X	X			X			X
CHME 305 Transport Operations I: Fluid Flow	X		X		X		X				X
CHME 306 Transport Operations II: Heat and Mass Transfer	X		X	X	X		X				X
CHME 307 Transport Operations III: Staged Operations	X		X		X		X				X
CHME 352L Simulation of Unit Operations	X				X						X
CHME 361 Engineering Materials	X			X	X			X		X	
CHME 441 Chemical Kinetics and Reactor Engineering	X	X	X	X	X	X	X			X	X
Number of times an outcome is measured in required AE courses for EP-CHE majors.	***10***	***3***	***4***	***6***	***10***	***3***	***6***	***2***	***1***	***3***	***9***

The methods used to assess the assigned *Program Outcomes* in courses and the ways on how measurements are enforced are under the control of the *Department of Chemical & Materials Engineering*.

For a discussion of changes in the *EP Curriculum* with the *Chemical Concentration* compared to the 2012 catalog, see *Criterion 5 – Curriculum*.

Table 3.2.d. *Current Electrical-Engineering Course Assessment Matrix for Program Outcomes (a)-(k). Only required courses for EP majors with the Electrical Concentration are included. For EP-EE students, Program Outcome (i) is not separately measured in EE courses required for their major.*

Required Mechanical or Aerospace Engineering Course for EP-AE majors	***Program Outcome***										
	(a)	***(b)***	***(c)***	***(d)***	***(e)***	***(f)***	***(g)***	***(h)***	***(i)***	***(j)***	***(k)***
EE 100 Introduction to Electrical and Computer Engineering	X		X	X							
EE 112 Embedded Systems	X		X	X	X						
EE 200 Linear Algebra and Probability	X	X			X						X
EE 212 Computer Organization and Design						X		X		X	
EE 230 AC Circuits and Introduction to Power	X	X			X		X				X
EE 317 Semiconductor Devices and Electronics I	X		X				X				X
EE 320 Signals and Systems I	X	X									
EE 340[a)] Fields and Waves	X	X		X	X						
Number of times an outcome is measured in required EE courses for EP-AE majors.	***7***	***4***	***3***	***3***	***4***	***1***	***2***	***1***		***1***	***3***

[a)]EP-EE student can satisfy the EE 340 requirement by taking PHYS 462 instead.

The methods used to assess the assigned *Program Outcomes* in courses and the ways on how measurements are enforced are under the control of the *Department of Electrical & Computer Engineering*.

For a discussion of changes in the *EP Curriculum* with the *Electrical Concentration* compared to the 2012 catalog, see *Criterion 5 – Curriculum*.

Table 3.2.e. *Current Mechanical-Engineering Course Assessment Matrix for Program Outcomes (a)-(k). Only required courses for EP majors with the Mechanical Concentration are included. For EP-ME students, Program Outcomes (h) and (i) are not separately measured in ME courses required for their major.*

Required Mechanical Engineering Course for EP-ME majors	***Program Outcome***										
	(a)	***(b)***	***(c)***	***(d)***	***(e)***	***(f)***	***(g)***	***(h)***	***(i)***	***(j)***	***(k)***
ME 159 Graphical Communication and Design			X								X
ME 236 Engineering Mechanics I	X				X						
ME 237 Engineering Mechanics II					X						
ME 240 Thermodynamics					X						
ME 261 Mechanical Engineering Problem Solving	X				X						X
ME 326 Mechanical Design			X	X		X				X	
ME 338 Fluid Mechanics	X	X	X		X						
ME 341 Heat Transfer	X				X						
ME 345 Experimental Methods I		X					X				X
ME 425 Aerodynamics I	X	X	X		X						
Number of times an outcome is measured in required ME courses for EP-ME majors.	***5***	***3***	***4***	***1***	***7***	***1***	***1***			***1***	***3***

The methods used to assess the assigned *Program Outcomes* in courses and the ways on how measurements are enforced are under the control of the *Department of Mechanical & Aerospace Engineering*.

For a discussion of changes in the *EP Curriculum* with the *Mechanical Concentration* compared to the 2012 catalog, see *Criterion 5 – Curriculum*.

Table 3.2.f. *Current Engineering Course Assessment Matrix for Program Outcomes (a)-(k) for ENGR 100 (required by all EP majors), CE 301 (required by EP-AE and EP-ME majors) and Engineering Design Capstone (required by all EP majors).*

Other Engineering Courses for EP majors	***Program Outcome***										
	(a)	***(b)***	***(c)***	***(d)***	***(e)***	***(f)***	***(g)***	***(h)***	***(i)***	***(j)***	***(k)***
ENGR 100 Introduction to Engineering				X		X	X	X	X	X	X
CE 301 Mechanics of Materials	X		X		X						
Engineering Design Capstone (2 courses)			X				X				X
Number of times an outcome is measured in other engineering course.	***0-1***		***1-2***	***1***	***0-1***	***1***	***2***	***1***	***1***	***1***	***2***

Each instructor teaching a physics course is responsible for measuring the assigned *Program Outcomes*, complete the *Post-Course Instructor Comment Form* and save it and other relevant materials to the designated *OneDrive* folder. All physics faculty members have access to this folder, and 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 Reviews* are also stored in another folder on *OneDrive*.

Documentation for Assessment of *Program Outcomes*

After completion of a physics course that may be taken by EP students as part of their curriculum, the course instructors of these courses are required to fill out a *Post-Course Instructor Comment Form* (see *Appendix E – Supplementary Documents*), which summarizes class details, results of *Program Outcome* measurements, and some general comments. The *Post-Course Instructor Comment Form* and other course-related materials are collected in so-called *'Maroon' Instructor Notebooks*, which are called 'maroon' because print-outs of the materials had been collected in maroon-colored binders for many years. As a practical matter, we began keeping the notebooks online in 2008, and print only the most relevant material for the ABET site visit. The completed *Post-Course Instructor Comment Form* and other course-related materials are then uploaded by the instructor to a *OneDrive* folder designated to the *EP Program* every time a course was taught. This provides important feedback to instructors of future course and ensures continuity. Virtual notebooks are available to all faculty and are more useful in that form. The EP-designated *OneDrive* folder also contains data on non-course *Program Outcomes* measures.

Supplementary *'White' Course Notebooks* are prepared once every 6 years, just prior to an ABET accreditation visit. The *'White' Course Notebooks* contain examples of student work for all assignments the last time a course was taught prior to the ABET site visit.

Finally, there are separate *'Blue' Program Outcomes Notebooks*, which contains data, summaries and reports for each of the *Program Outcomes (a)-(k).*

A list of contents for the *'Maroon'*, *'White'* and *'Blue' Notebooks* is provided in *Appendix E – Supplementary Documents*.

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 introduced and discussed in more detail in *Criterion 2 – Educational Objectives*. The *Educational Objectives* for the *EP Program* are *Objective 1 – Competitiveness*, *Objective 2 – Adaptability*, and *Objective 3 – Teamwork and Leadership*.

Table 3.3 provides an attempt to identify primary and secondary relationships between the *Program Outcomes (a)-(k)* and the *Educational Objectives (1)-(3)* of the *EP Program*. 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 an '**X**' in the table). *Program Outcomes* may also map to secondary *Educational Objective(s),* but we do not formally evaluate them for that purpose (marked with a '**s**' in the table).

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 Objective	***Program Outcome***										
	(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
Objective 1	**X**	**s**	**X**		**X**						**X**
Objective 2	**s**		**s**	**s**	**s**	**s**	**s**	**X**	**X**	**X**	**s**
Objective 3		**X**		**X**		**X**	**X**	**s**			

As discussed in *Criterion 2 – Educational Objectives*, the feedback from our *Engineering Physics External Advisory Board* (EPEAB) provides evidence that the *EP Program* achieves its stated *Educational Objectives*, as evidenced by the success of our alumni, their career choices, and employment history, for example. This should be taken as evidence that our efforts toward *Program Outcomes* and *Continuous Improvement* (see *Criterion 4*) are generally supportive in achieving the program's *Educational Objectives*.

CRITERION 4. CONTINUOUS IMPROVEMENT

This section discusses improvements to our *Engineering Physics (EP)* program during the last ABET cycle (2012-2018). In general, these improvements were made as the result of a whole series of different assessment results, which can be roughly categorized into: *Program Quality* 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.

Quality of Instruction is regularly assessed by the following means:

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

NMSU requires that students 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)*

Instructors of various physics courses administer a *Pre-Requisite Test* at the beginning of a course. The main goal of the *Pre-Requisite Test* is to identify whether instruction of necessary pre-requisite materials from previous courses was adequate.

Faculty *Annual Performance Reports* *(once per year)*

Each faculty member is required to submit an *Annual Performance Report* (APR) of his/her performance over the past year. NMSU uses the *Digital Measures* system for the evaluation of individual faculty performance in the areas of scholarship/research, teaching, service and outreach, depending of the faculty's allocation of effort. For the teaching portion of the APR, faculty members are usually expected to include up to three independent measures of teaching effectiveness for courses that he/she taught in the previous year. Some acceptable measures are summaries of student feedback related to teaching experience, self-reflection and discussion of perceived strength or weaknesses in teaching, class-room visits and an evaluation by other faculty members and/or representatives from NMSU's *Teaching Academy*, and/or data on student performance for course material after instruction, as evidenced by separately administered (national) tests. In cases where there are identified weaknesses in a faculty member's teaching, the *Department Head* will discuss ways to address such deficiencies with the faculty member.

In addition, more general feedback about *Program Quality* is obtained by the following means:

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

As pointed out in *Criterion 2 - Educational Objectives*, the *Engineering Physics External Advisory Board* (EPEAB) consists of members from all the program's major constituents, i.e. faculty members from other academic institutions, researchers from national laboratories, industry representatives, and *EP Program* alumni. During their on-campus site visit, the EPEAB meets with physics faculty and other program representatives, and they evaluate all aspects of the *EP Program*, including *Program Quality*. If necessary, the EPEAB report will also provide guidance for the *EP Curriculum*, including suggestions about course materials and content that may increase the *Program Quality*. For example, the EPEAB provided input about the relevance of existing courses and/or their content in the past.

Course Offerings to Individual Students *(occasionally)*

Although the *Department of Physics* has limited teaching strength and therefore course offerings are limited, many of the physics faculty members are willing to teach a course to individual *EP students* outside of the regular curriculum (with no teaching credit) to accommodate a student's curricular needs and/or interests. This is particularly important for the EP students where required courses in engineering and physics may have a time conflict. The *EP Program Committee* tries to minimize such time conflicts as much as possible, but they are occasionally unavoidable.

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

The assessment of *Program Outcomes* will be discussed in greater detail in section *A. Program Outcomes* below. *Program Outcomes Assessment* invokes 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 rare occasions, instructors volunteer additional *Program Outcomes* metrics, 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*. *Program Outcomes Summary* assignments to individual faculty members are distributed about every 2 years. In general, such summaries are due along with the APR (usually, in September or October). Non-compliance of providing the assigned *Outcomes Summary* results in a deficiency in the faculty member's service contribution for that year. An example of a completed *Program Outcomes Summary* is provided in *Appendix E – Supplementary Documents*.

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

The *Head of the Department of Physics* or a designee performs 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 form used for the *Senior Student Exit Interviews* (SSEI) is provided in *Appendix E - Supplementary Documents*. Since Spring of 2018, data for the SSEI are collected electronically and stored in a designated *OneDrive* folder.

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. These measurements provide the foundation for the *Program Outcomes* Summaries, which are then documented in the *'Blue' Program Outcomes Notebook*; see *Appendix E – Supplementary Documents* for a detailed list of contents of this notebook.

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 are represented on the *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*

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 (for details, see *Criterion 3 - Program Outcomes*); b) problems provided in the *TIPERs: Electricity & Magnetism Tasks* (by Hieggelke, Maloney, O'Kuma, and 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 were collected in 200-level physics courses each time they are taught, i.e. PHYS 213, 214, 215G, 216G, and 217. In addition, there has been one measurement in PHYS 315. We also asked exiting seniors to evaluate our impact on this outcome in the *Senior Student Exit Interviews* (SSEI); see *Appendix E – Supplementary Documents*. In addition, we included the *ETS® Major Field Test in Physics* (MFT) *Subscore* for *Introductory Physics* in the assessment of this *Program Outcome*; for details, see *Criterion 3 - Program Outcomes*.

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 FCI 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 national standards or similar benchmarks, 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 (MFT and *Mastering Physics*®).

Program Outcome (b) - Experimental Training

This *Program Outcome* is supposed to assess if 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 homework; 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 most (but not all) 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 SSEI.

The target level is set by the instructor depending on the method used. In many cases, the departmental average or a B grade average is used by instructors as the target value. In other cases, however, the instructor set an appropriate benchmark 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.

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. However, no data related to this outcome were collected in PHYS 471 and PHYS 475. We also asked exiting seniors to evaluate our impact on this outcome in the SSEI.

The targets were 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.

Program Outcome (d) - Teamwork

This *Program Outcome* determines whether students can work as effective members of a team, and if they are able to take responsibility for some or all aspects of a common goal. This was typically assessed using *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, 471, 475 and 493. Moreover, we recently added PHYS 217L to the list of courses measuring this outcome. Except for PHYS 315L, data are relatively sparse. We also asked exiting seniors to evaluate our impact on this outcome in the 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.

Program Outcome (e) - Problem Solving

This *Program Outcome* measures students' scientific understanding and ability to solve physics and engineering problems. It was assessed mostly by using *Graduate Record Exam* (GRE) questions embedded into exams, tests or quizzes. In PHYS 451, the FCI was used to measure this outcome.

Data were 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 SSEI. In addition, we included the MFT *Subscore* for *Advanced Physics* in the assessment of this *Program Outcome*

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 and MFT results, 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.

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 was measured in a variety of courses (although not necessarily consistently), such as PHYS 303V, 305V, 315, 315L, 451, 462, 471, 475, 480, 488, and 493. We also asked exiting seniors to evaluate our impact on this outcome in the 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.

Program Outcome (g) - Communication Skills

This *Program Outcome* measures the students' ability to present information (both oral 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.

This outcome measured in all PHYS 315L, and some PHYS 461, 471, 475 and 493 courses. We also asked exiting seniors to evaluate our impact on this outcome in the 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.

<u>Program Outcome (h) - Societal Impact</u>

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 using: a) *Subscores* in essays or project reports; b) specific homework assignments; and c) class participation.

This outcome was measured in many PHYS 305V, 315, 451, 462, 480, and 489 courses. We also asked exiting seniors to evaluate our impact on this outcome in the 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 met. Achievement of this *Program Outcome* is determined with comparatively low confindence because only few assessment tools are used.

<u>Program Outcome (i) - Lifelong Learning</u>

This *Program Outcome* attempts to measure students' understanding of the need for lifelong learning to accommodate rapid changes in science and technology. Assessment of the *Program Outcome* was done using: a) *Subscores* in essays or project reports; b) specific homework assignments; and c) *Subscores* in oral presentations.

This outcome was measured each time the relevant classes were taught, i.e. PHYS 315, 451, 462, 480, and 489. We also asked exiting seniors to evaluate our impact on this outcome in the SSEI. In addition, student participation in the MFT was taken as a measure of achievement for this *Program Outcome*

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

As can be seen in diagram 4.3.f, the targets are mostly met. The achievement of this *Program Outcome* has been a longstanding challenge, indicating the need of continued targeted effort in future courses. Achievement of this *Program Outcome* is determined with comparatively low confindence because only few assessment tools are used.

<u>Program Outcome (j) - Contemporary Issues</u>

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 in several PHYS 303V, 305V, 315, 451, 461, 462, 480, 488, and 489 courses. We also asked exiting seniors to evaluate our impact on this outcome in the 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..

<u>Program Outcome (k) - Technical Know-how</u>

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 the *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 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 courses, and all *Program Outcome* measures are compiled in the *Program Outcomes Notebooks*.

Diagram 4.3.a. *Measured level of achievement (normalized to the stated target) of all courses for Program Outcome (a) since Fall of 2012. Data from Senior Student Exit Interviews (SSEI) and Major Field Tests (MFT) are included.*

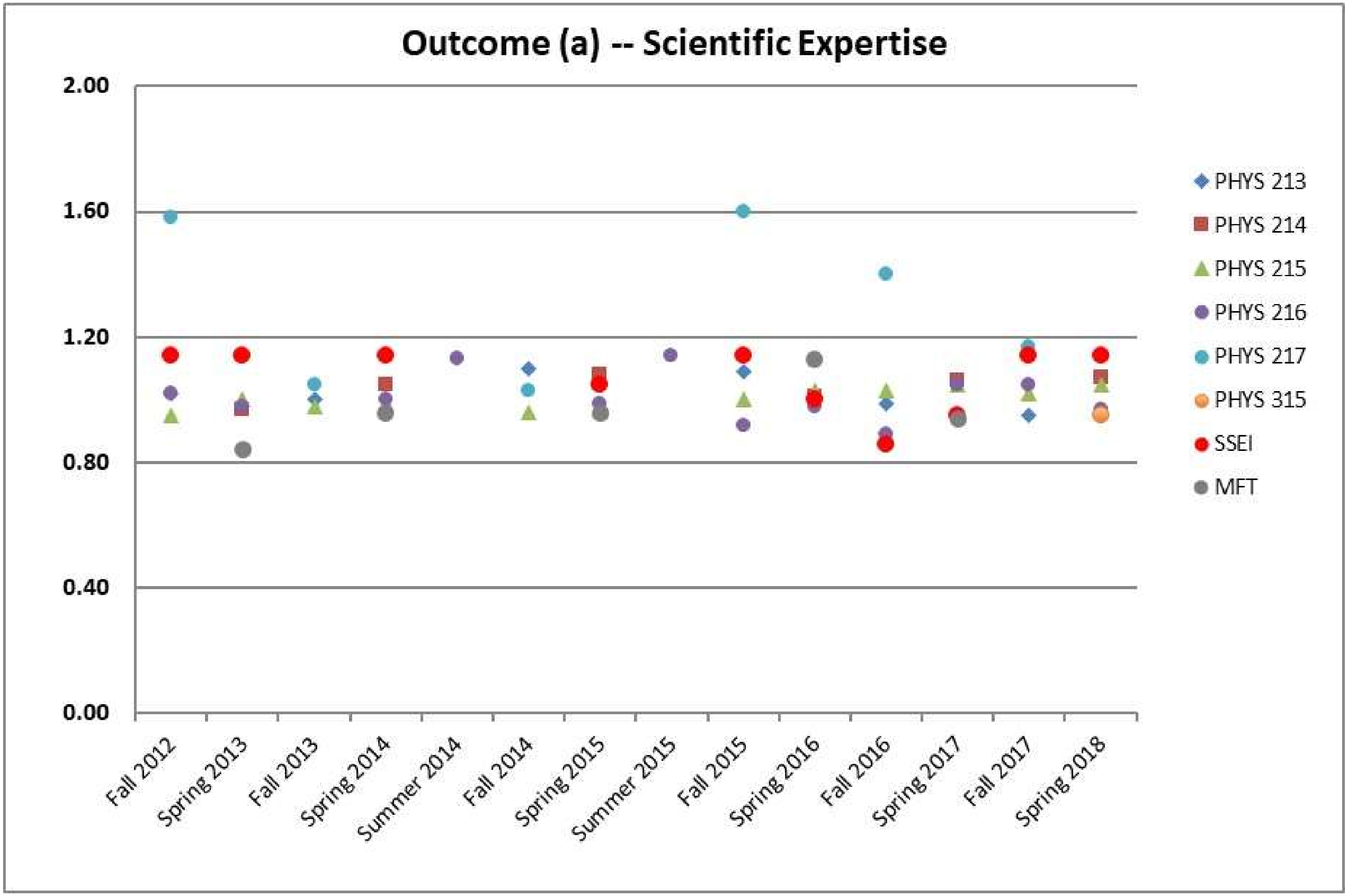


Diagram 4.3.b. *Measured level of achievement (normalized to the stated target) of all courses for Program Outcome (b) since Fall of 2012. Data from Senior Student Exit Interviews (SSEI) are included.*

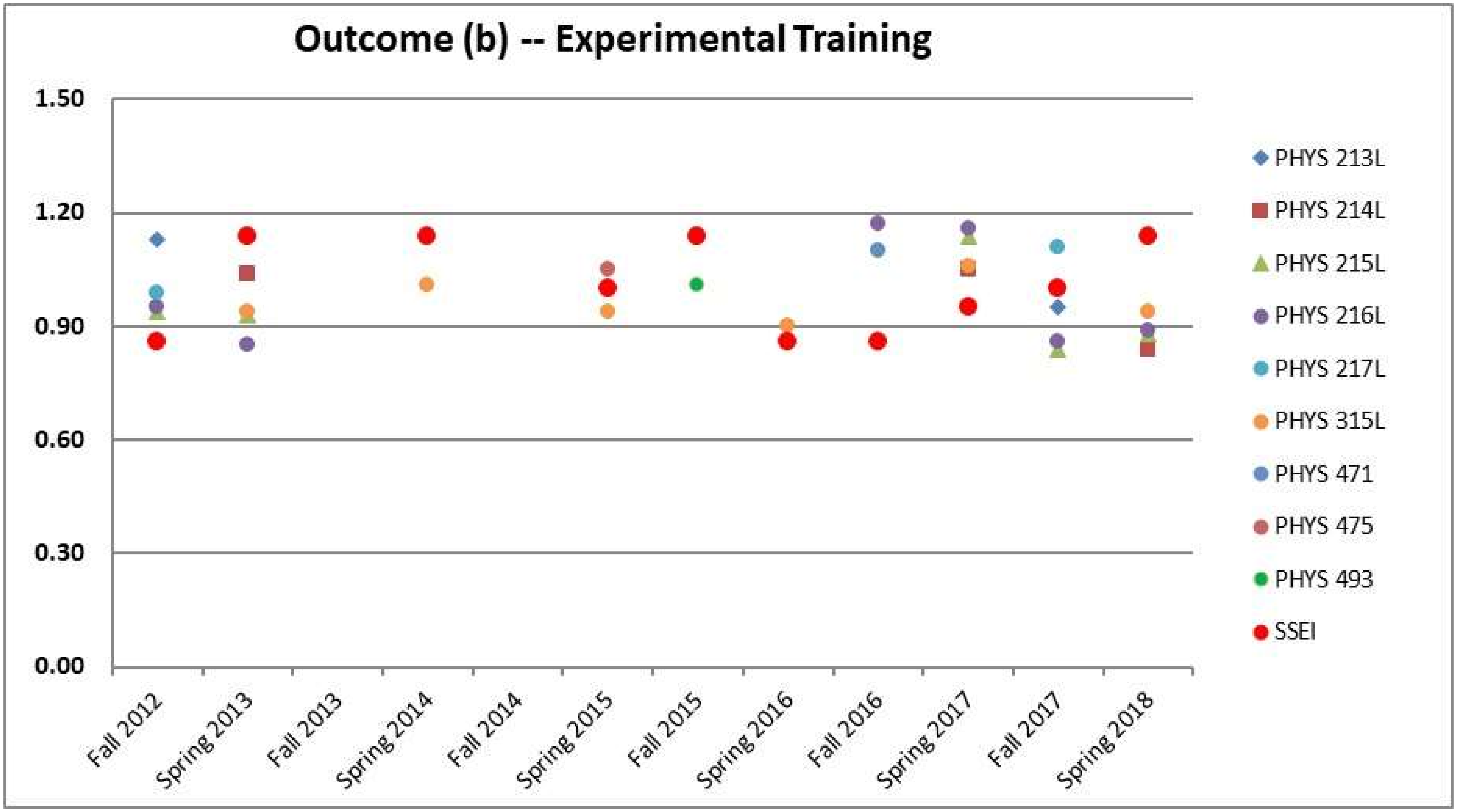


Diagram 4.3.c. *Measured level of achievement (normalized to the stated target) of all courses for Program Outcome (c) since Fall of 2012. Data from Senior Student Exit Interviews (SSEI) are included.*

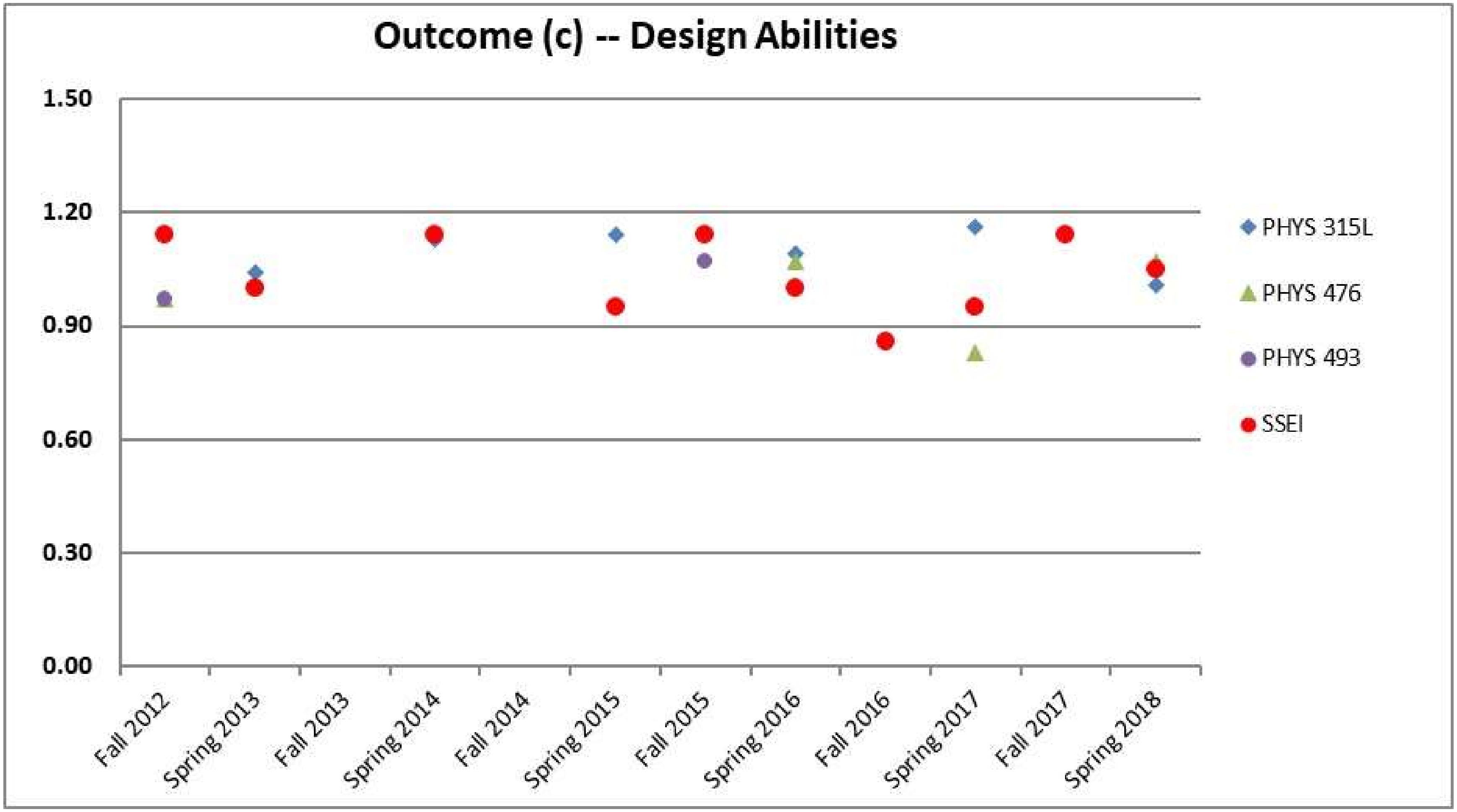


Diagram 4.3.d. *Measured level of achievement (normalized to the stated target) of all courses for Program Outcome (d) since Fall of 2012. Data from Senior Student Exit Interviews (SSEI) are included.*

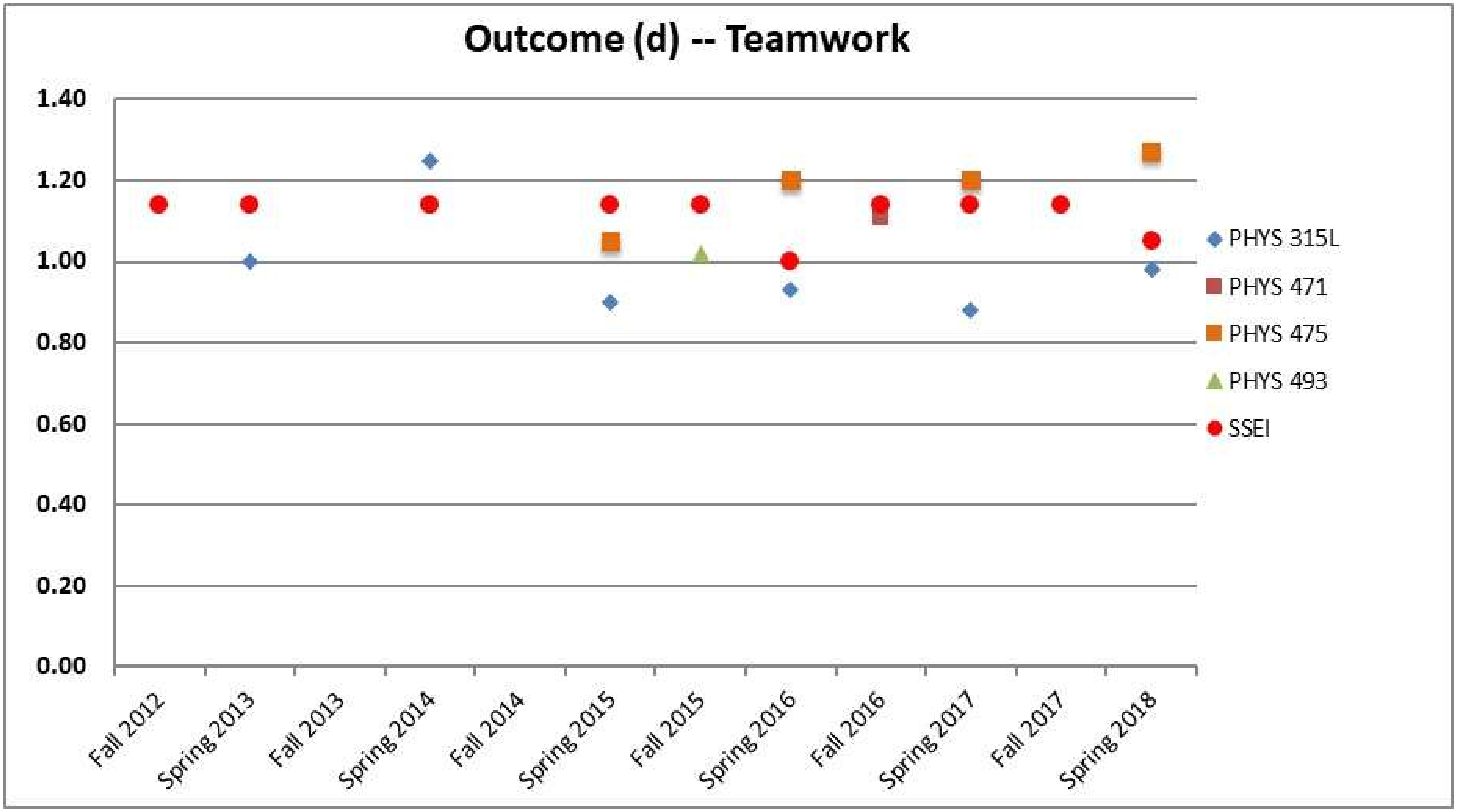


Diagram 4.3.e. *Measured level of achievement (normalized to the stated target) of all courses for Program Outcome (e) since Fall of 2012. Data from Senior Student Exit Interviews (SSEI) and Major Field Tests (MFT) are included.*

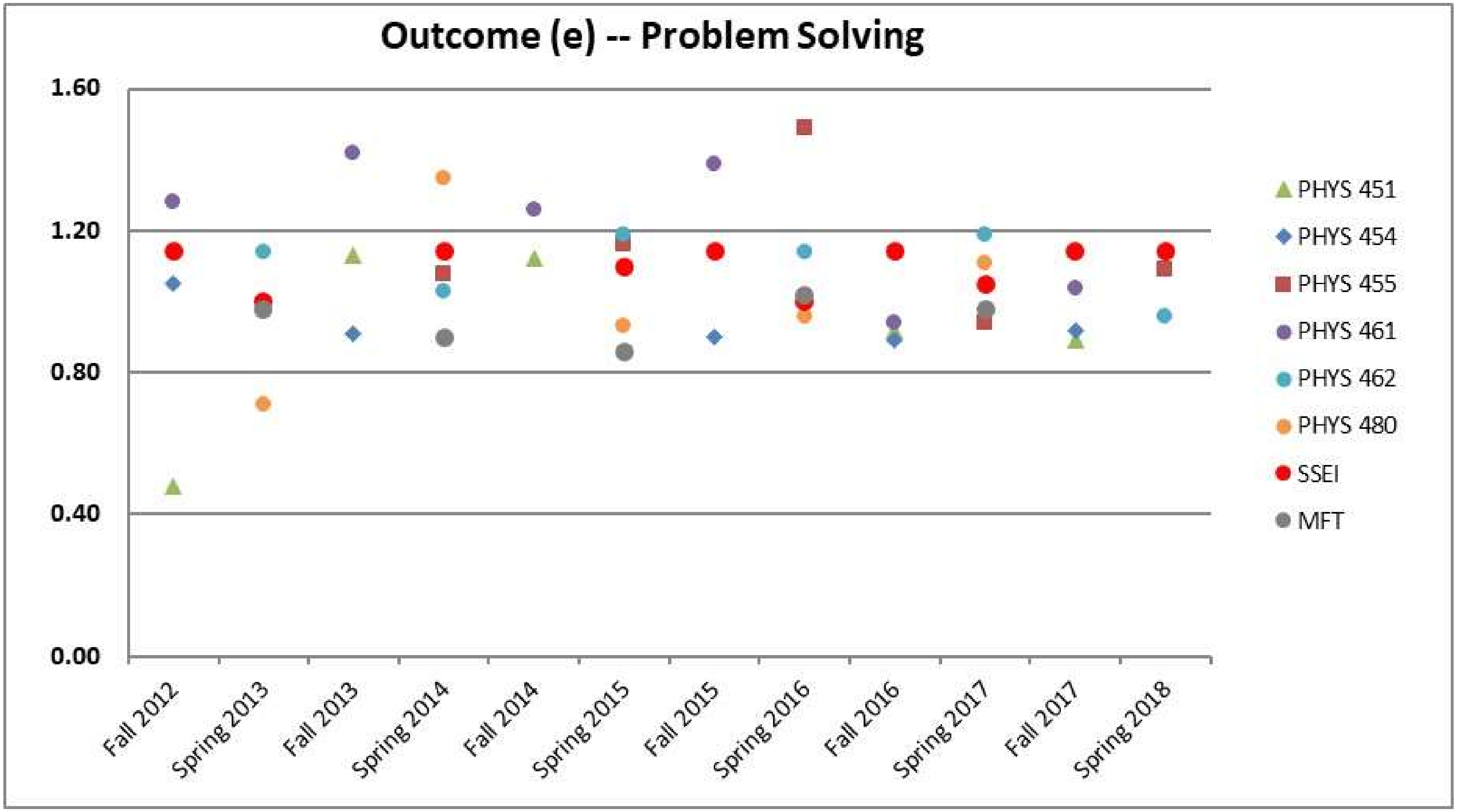


Diagram 4.3.f. *Measured level of achievement (normalized to the stated target) of all courses for Program Outcome (f) since Fall of 2012. Data from Senior Student Exit Interviews (SSEI) are included.*

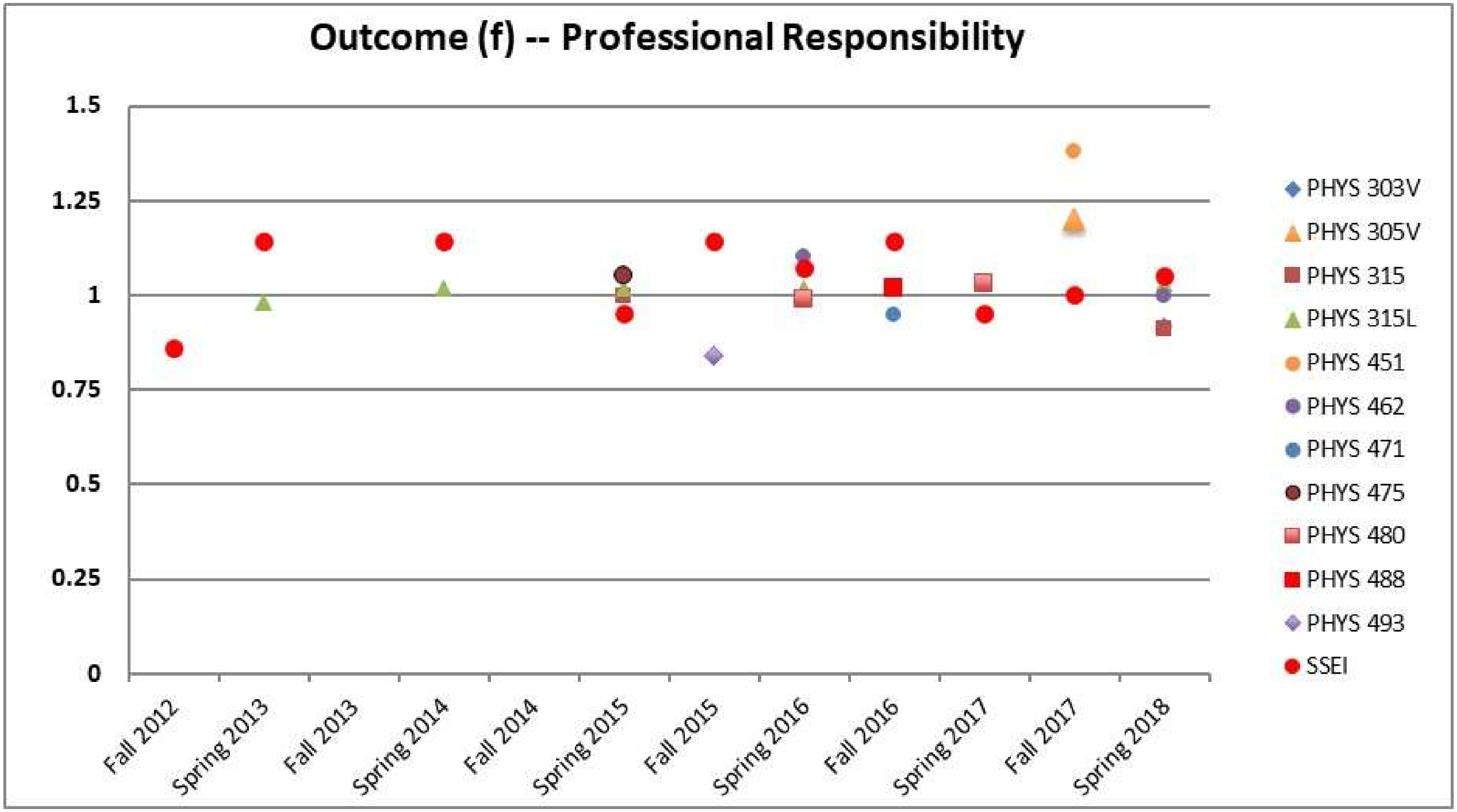


Diagram 4.3.g. *Measured level of achievement (normalized to the stated target) of all courses for Program Outcome (g) since Fall of 2012. Data from Senior Student Exit Interviews (SSEI) are included.*

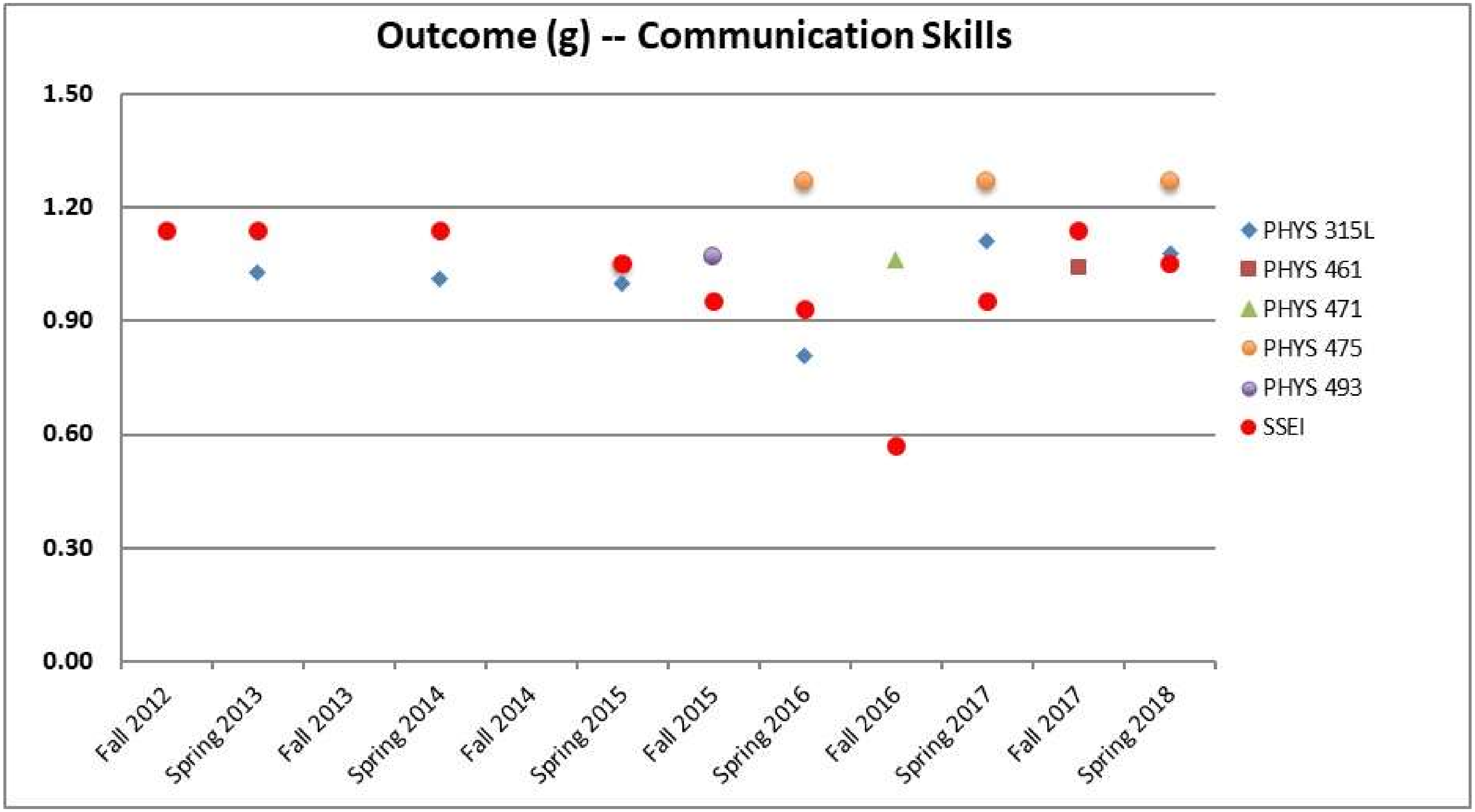


Diagram 4.3.h. *Measured level of achievement (normalized to the stated target) of all courses for Program Outcome (h) since Fall of 2012. Data from Senior Student Exit Interviews (SSEI) are included.*

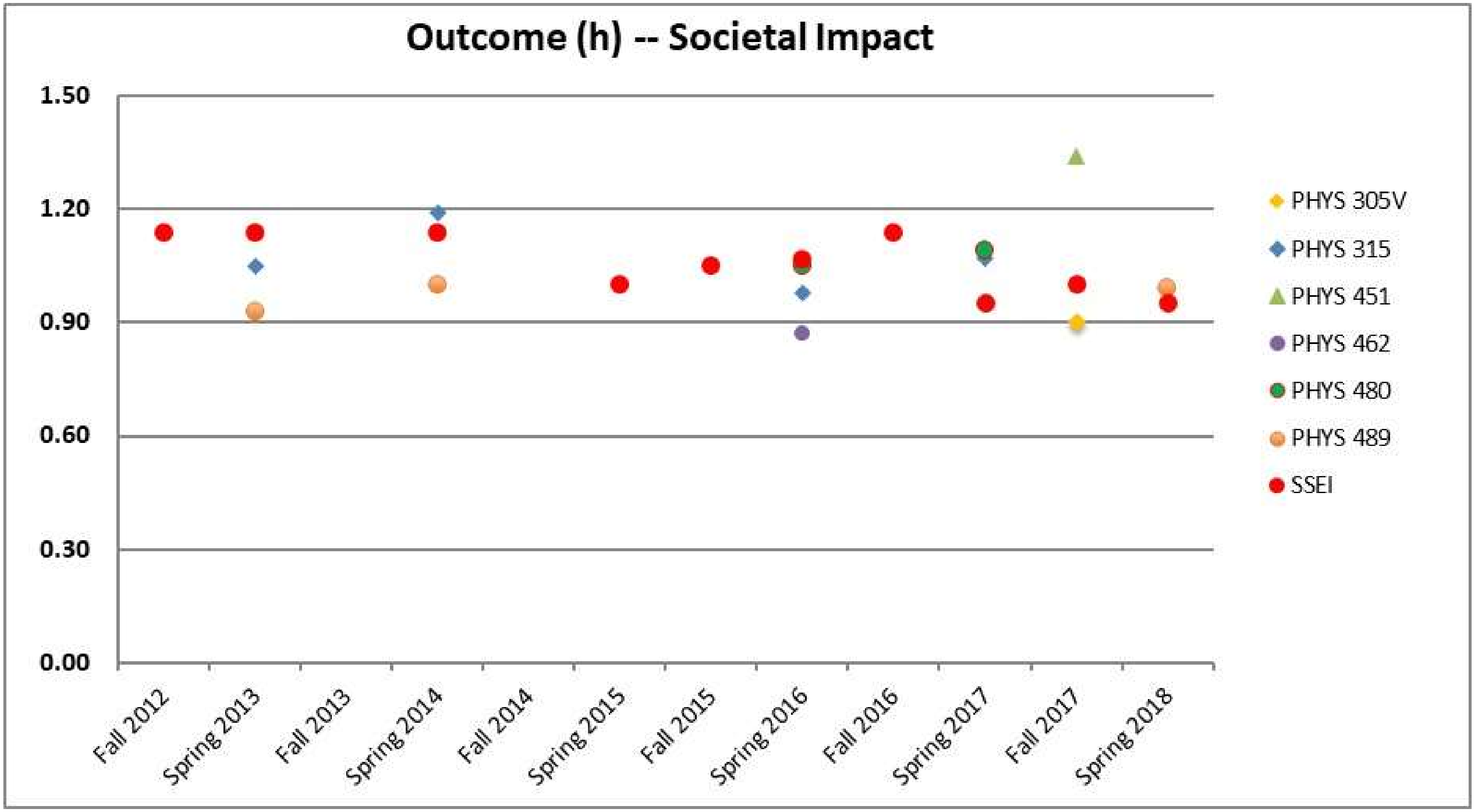


__Diagram 4.3.i.__ Measured level of achievement (normalized to the stated target) of all courses for Program Outcome (i) since Fall of 2012. Data from Senior Student Exit Interviews (SSEI) and Major Field Tests (MFT) are included.

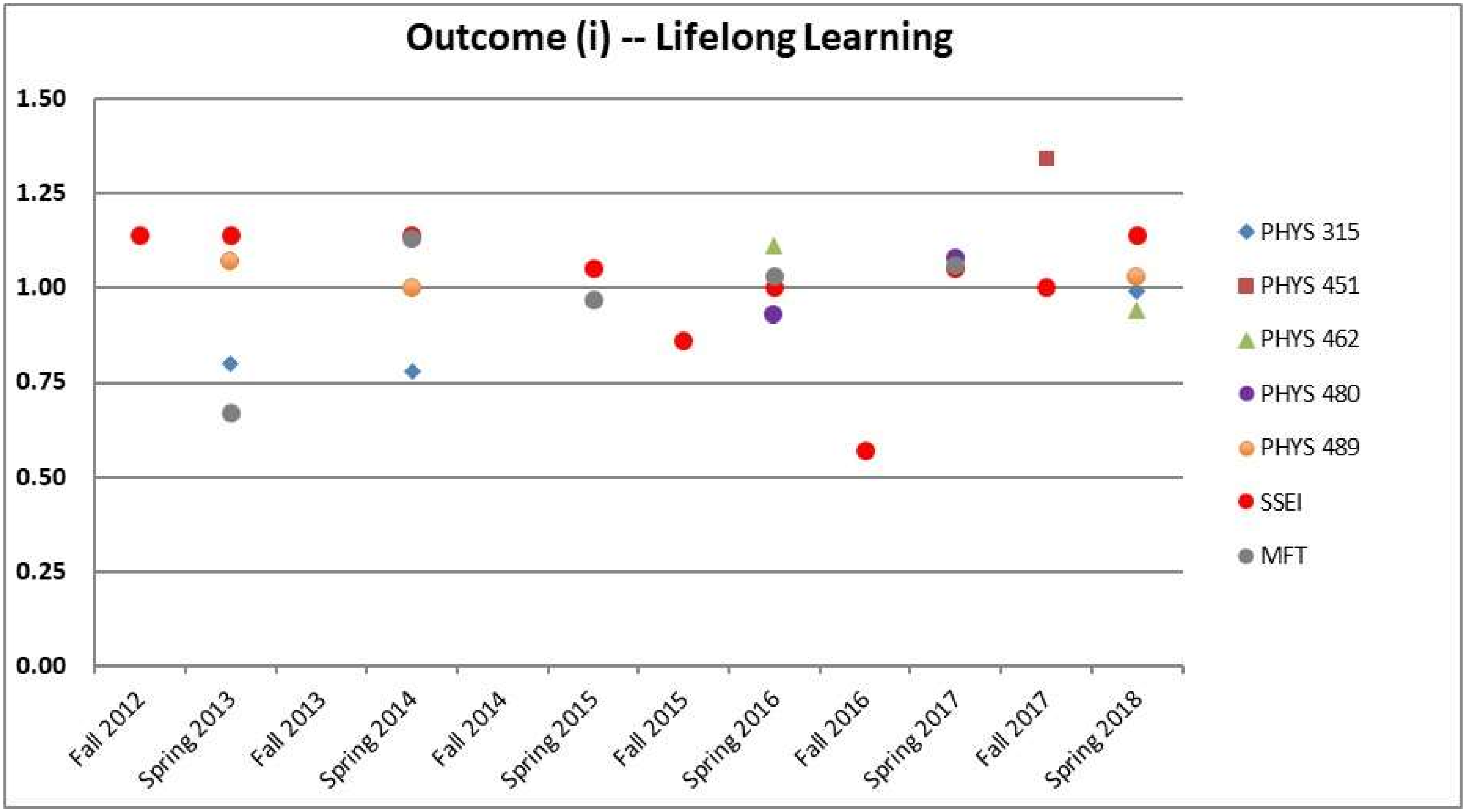


Diagram 4.3.j. *Measured level of achievement (normalized to the stated target) of all courses for Program Outcome (j) since Fall of 2012. Data from Senior Student Exit Interviews (SSEI) are included.*

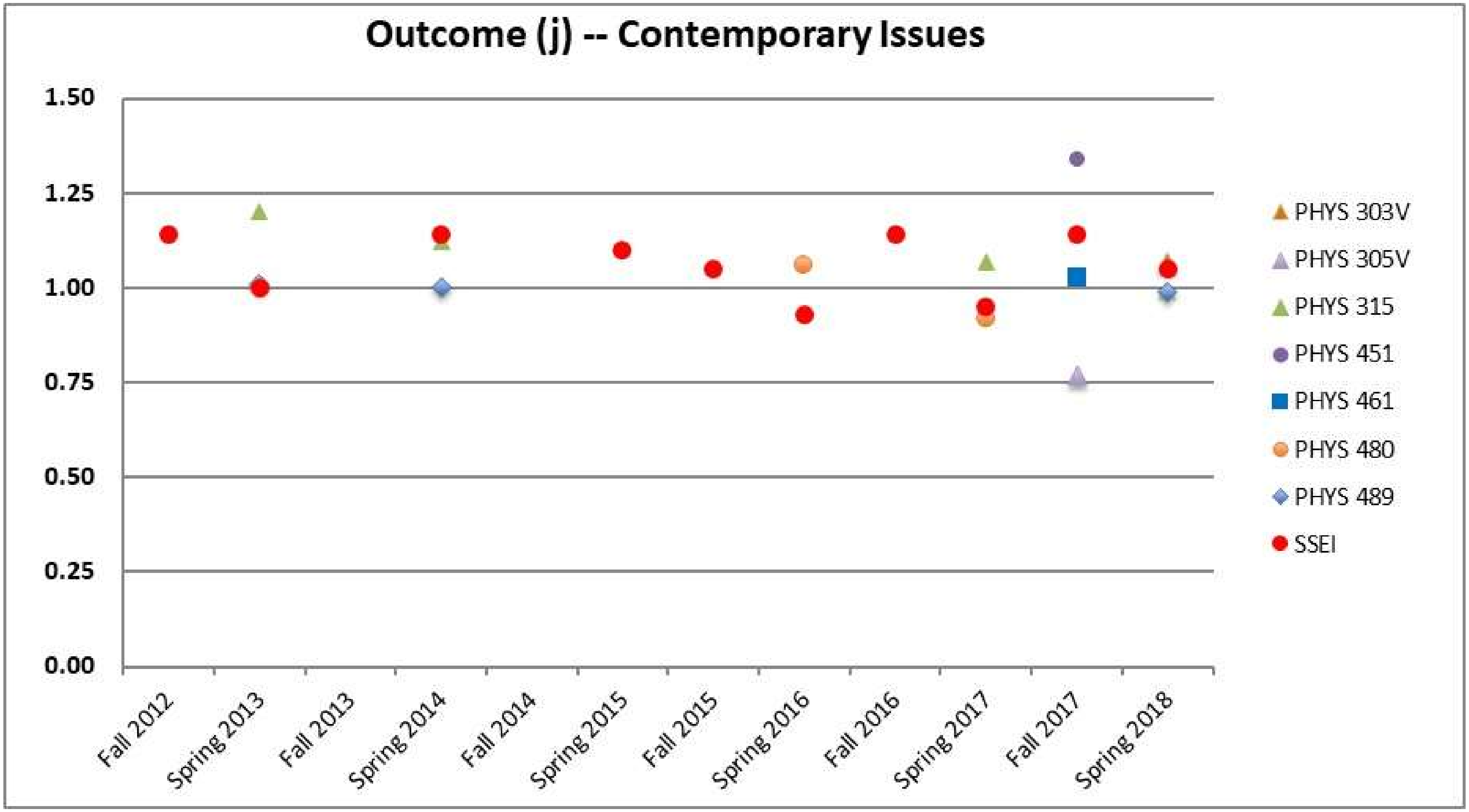
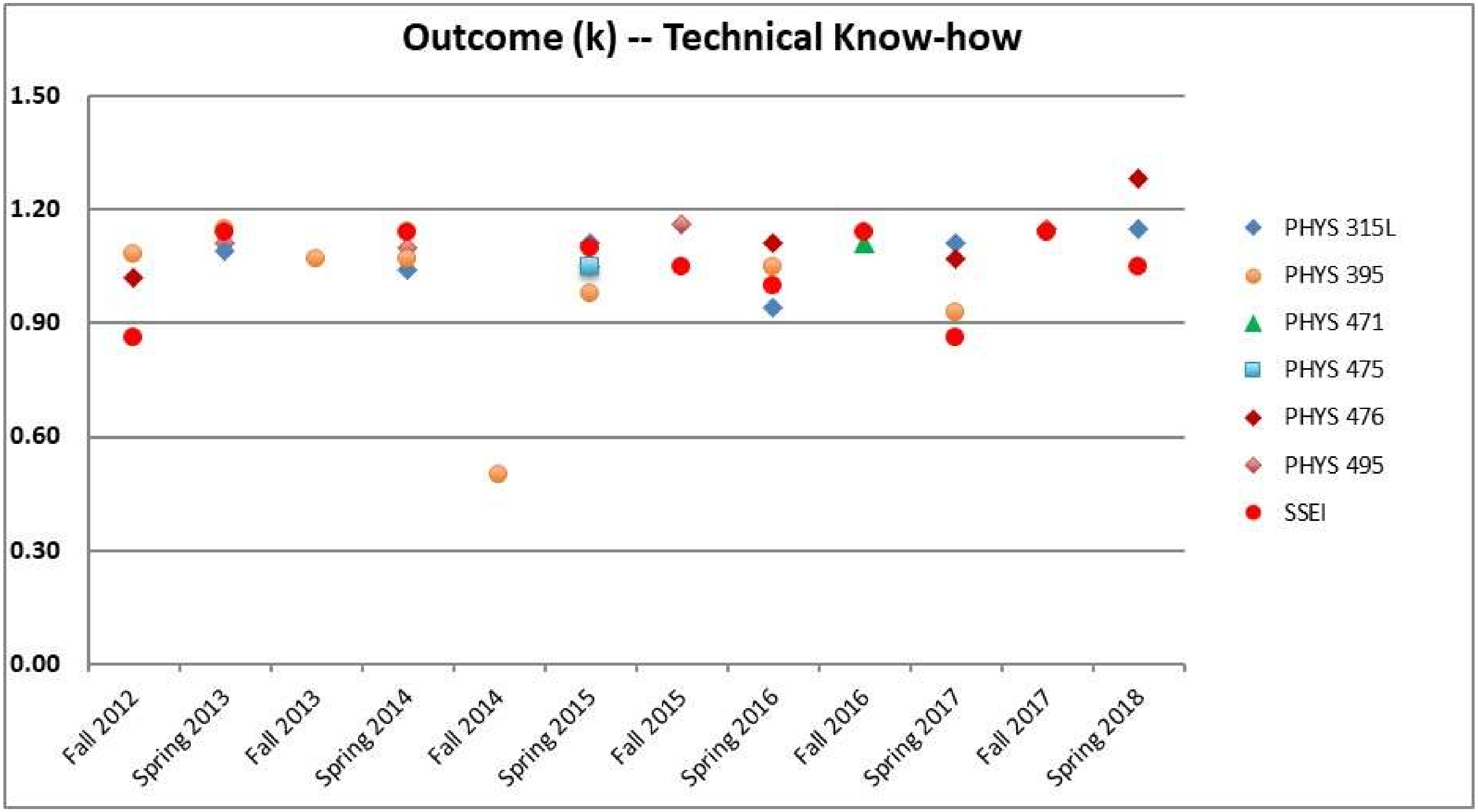


Diagram 4.3.k. *Measured level of achievement (normalized to the stated target) of all courses for Program Outcome (k) since Fall of 2012. Data from Senior Student Exit Interviews (SSEI) are included.*



Summaries of *Program Outcomes* Assessment in *Engineering Departments*

Course Program Outcomes Assessment in the *Department of Mechanical & Aerospace Engineering*

The required AE and ME courses of EP-AE majors, used to assess individual *Program Outcomes (a)-(k)* in the *Department of Mechanical & Aerospace Engineering*, are listed in the assessment matrices in Tables 3.2.b (AE courses) and 3.2.e (ME courses). The assessments are reviewed by a departmental *Outcomes and Assessment Committee* (OAC) once per semester in the *Department of Mechanical & Aerospace Engineering.*

For EP-AE majors, no quantitative data from engineering courses were collected for *Program Outcomes (f) – Professional Responsibility, (h) – Societal Impact* and *Program Outcome (i) – Lifelong Learning*. For EP-ME majors, no quantitative data from engineering courses were collected for *Program Outcomes (h) – Societal Impact* and *Program Outcome (i) – Lifelong Learning*. For *Aerospace Engi*neering and *Mechanical Engineering* majors, meeting these *Program Outcomes* was evidenced by students' written responses of student surveys in the *ME 449 – Senior Seminar course*, administered at the beginning and at the end of the semester. However, this course is not required for our EP-AE or EP-ME majors. Other *Program Outcomes* were measured quantitatively through a variety of assessment tools in relevant ME and AE courses (see Tables 3.2.b and 3.2.e).

The collected materials and data provide the aggregate gauge that all other *Program Outcomes* were found to be mostly satisfied. However, a few individual courses and/or instructors fell short of the expected achievements. For example, there had been some low achievement scores particularly for *Program Outcome (e) – Problem Solving,* which was addressed by adding additional *Problem-Solving Sessions* and *Practice Tests* to some of the ME and AE courses, such as ME 234, ME 236 and ME237. In general, to address 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 to:

- to evaluate the results from the flowchart report from each course instructor and ensure

that the improvement plan is adequate, and

- 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 were deemed inadequate, a new or revised plan may be proposed and carried out in future semesters. Another assessment tool is the exit interviews for graduating mechanical engineering majors, where graduates provide feedback about the quality of instruction and/or course content. Comments directed to specific faculty member's teaching style and/or shortcomings are addressed by the department head with consultation from faculty members during the annual performance evaluation. Finally, the OAC seeks feedback from the IAC, which provides important input on the necessary skills for graduates entering the job market and for success in their careers.

More details on the *Program Outcomes Assessment* through AE courses can be found in the *Aerospace Engineering Self Study Report*, and more details on Program Outcomes Assessment through ME courses *Mechanical Engineering Self Study Report*.

Course Program Outcomes Assessment in the *Department of Electrical & Computer Engineering*

The required EE courses of EP-EE majors, used to assess individual *Program Outcomes (a)-(k)* in the *Department of Electrical & Computer Engineering*, are listed in the assessment matrix in Table 3.2.d. For EP-EE majors, no quantitative data from engineering courses were collected for *Program Outcomes (h) – Societal Impact*. This outcome is assessed in other EE courses that are not required for EP-EE majors.

The *Department of Electrical & Computer Engineering* periodically reviews the achievement of each of the *Program Outcomes*, and changes are made if targets are not met or barely met, often after consultation with the department's *Industrial Advisory Group* (IAG). A few examples of recent changes in EE courses are:

- introduction of metacognition exercises in EE 310 to improve student learning methods - addresses *Program Outcomes (a) – Scientific Expertise* and *(d) – Teamwork.*
- require upper-division electives to include lifelong-learning and ethics exercises – addresses *Program Outcomes (f) – Professional Responsibility*, *(g) – Communication Skills* and *(i) – Lifelong Learning.*
- modified EE4 18 Capstone I to require prototyping of critical subsystems based on *Risk Analysis* - addresses *Program Outcomes (c) – Design Abilities.*

More details on the *Program Outcomes Assessment* through EE courses can be found in the *Electrical Engineering Self Study Report*.

Course Program Outcomes Assessment in the *Department of Chemical & Materials Engineering*

The required CHME courses of EP-CHE majors, used to assess individual *Program Outcomes (a)-(k)* in the *Department of Chemical & Materials Engineering*, are listed in the assessment matrix in Table 3.2.c. A compilation of so-called *Course Assessment Records* (CARs) data is accomplished through use of a form-driven interface located on the website of the *Department of Chemical & Materials Engineering*. This form provides a *Wordpress Access Table* for *Continuous Improvement & Management of Change* database. *Program Outcomes Assessment* data are reviewed by the *Department Head* as it is submitted. Faculty review the CARs reports of:

- courses that are prerequisite to those courses they teach; and
- courses for which the courses they teach are prerequisite.

Findings and trends are discussed at the *Annual Faculty Assessment Meeting* of the *Department of Chemical & Materials Engineering*. CARs assignments for the subsequent year are formed by a committee of the whole at the *Annual Assessment Meeting*. Where the achievement of targets failed, the CAR for that course will be reassessed in the following academic year to assure recommended changes lead to success. Faculty document their assessment responsibilities in the database in real time as the assessments are completed.

More details on the *Program Outcomes Assessment* through CHME courses can be found in the *Chemical 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 or 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.

<u>Efforts to Increase Retention</u>

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

a) 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.

b) Traditionally, each engineering department has had its own "introductory" engineering course, but there was no uniform format nor any coordination between them.

c) 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.

d) 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*

a) We sought to increase the level of tutoring provided to Physics and EP students, within the Physics department.

b) 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).

c) *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.*

d) *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*

a) *We continue to note student difficulties in 200-level lecture courses, which affects learning and our retention rate.*

b) *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.*

c) *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.*

d) *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*

a) *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 affects whether incoming students can enroll into introductory physics courses.*

b) *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. This ensures that EP students feel a sense of belonging to the program.*

c) *Using departmental funds, the Department of Physics supports a Physics Teaching Assistant, who can provide math tutoring free of charge for incoming students in their freshmen and sophomore year.*

d) *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*

a) *It is important to have intramural student groups that build relationships among students, promote civil teamwork, and improve retention.*

b) *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.*

c) *The level of 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).*

d) *The Department of Physics 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*

a) *This is part of our continuing effort to expose undergraduates to up-to-date research.*

b) *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.*

c) *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.*

d) *This is a continuing program.*

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

a) *Previously, the EP program did not have the same access to College of Engineering scholarships as other Engineering majors.*

b) *The Physics Department has extensive endowments, but with increased enrollment between the Physics and Engineering Physics programs we were unable to serve all our students. The College of Engineering has a scholarship committee but our program was not represented on this committee.*

c) *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.*

d) *Dr. Nakotte started to serve on this committee in 2016. The EP Scholarship was also started in 2016.*

<u>**Course Re-Design & Improvements**</u>

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

a) *There had been a longstanding disconnect between the computational instruction in the College of Engineering (largely MatLab-based) and that in the Physics department (either Fortran-based or lacking/omitted).*

b) *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 increasingly MatLab-based. The Department of Physics did not have any MatLab capabilities earlier.*

c) *The Physics Department has purchased a 25-seat license for MatLab for use in the PHYS 315L - Experimental Modern Physics and in the physics Computer Laboratory for use in other courses that have computational projects (PHYS 476 Computational Physics for example).*

d) *We first employed MatLab in the Physics department in Fall 2014. Since Fall of 2017, the University has purchased a campus license for MatLab, which is provided free-of-charge to the program. 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*

a) *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.*

b) *After a few semesters we learned the topics and the level of instruction that was of maximum concern to the students and of maximum need in the 400-level physics sequence.*

c) *Adjustments were made in the ordering and emphasis of the topics: vector calculus, complex numbers, linear algebra, and differential equations.*

d) *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*

a) *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.*

b) *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.*

c) *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.*

d) *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*

a) *It is desired to improve the pedagogical function of the experiments in the 213L, 214L, 215L, and 216L lab courses.*
b) *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.*
c) *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.*
d) *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*

a) *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 for 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*.
b) *The instructors agreed to increase the engineering content in those two courses either by including engineering-based/oriented homework problems or requiring engineering-based/oriented project reports.*
c) *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.*
d) *Supplementary engineering components were introduced starting in Spring of 2017, and it will continue to be a required component in PHYS 461 and 462.*

<u>Changes in the Course Curriculum</u>

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*

a) *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-requisite requirements to participate in the engineering capstones of their respective concentrations, none of the EP students would fulfill the pre-requisite 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 the capstone system that was in place. The situation was further complicated for EP students with the Chemical Concentration, who would need to take an additional 3 courses to satisfy the capstone pre-requisites in the Department of Chemical & Materials Engineering.*

b) *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 they meet the prerequisites?*

c) *A proposal was developed by Dr. Heinz Nakotte (Department of Physics) and Dr. Gabe Garcia (Department of Mechanical & Aerospace Engineering), to offer a single engineering-wide capstone course with an ENGR prefix that would be open to 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-requisite requirements for a capstone in their engineering major; EP pre-requisites would be considered satisfied with the students taking the Modern Physics Laboratory, PHYS315L. 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.*

d) *A pilot project (coordination between two separate Mini-Baja Capstones in Mechanical and Electrical Engineering) was started in Fall 2017 with the goal to see whether interdisciplinary and cross-departmental capstones could work. In Spring of 2018, the College of Engineering appointed Dr. Garcia as the Interim Director of the Aggie Engineering Capstone Design Program, which is in charge to develop and formalize such Engineering-Wide Capstones for future years.*

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

a) *For several semesters recently, the Physics Department only offered a single 400-level advanced laboratory course, PHYS 475; students commented on the lack of choices.*

b) *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.*

c) *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.*

d) *The PHYS 493 course started up again in Fall 2013, PHYS 471 was offered in Fall 2016, and both labs will be offered in Fall of 2018.*

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

a) *Some of the EP curricula include upper-division "technical electives" but students have complained about a lack of useful choices.*

b) *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.*

c) *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.*

d) *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 communicate with 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*

a) *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.*

b) *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.*

c) *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 have 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.*

d) *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*

a) *The NMSU Board of Regents expressed a desire that all students have a defined "experiential learning" opportunity during their time at NMSU.*

b) *A bill concerning this topic was put before the NMSU Faculty Senate in Fall 2017.*

c) *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.*

d) *We look forward to demonstrating that our students have always had these opportunities.*

<u>Instrumentation & Facility Upgrades</u>

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*

a) *There is always a need to maintain, repair, or replace instructional lab equipment that is faulty or out-of-date.*
b) *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.*
c) *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.*
d) *These items are in current use in the introductory 200-level labs, the PHYS 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*

a) *Most students prefer having access to departmental facilities, such as the Computer Lab, particularly when working on projects as a team.*
b) *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.*
c) *All EP students in good standing will be provided with key card access to some of the departmental facilities, such as the Physics 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.*
d) *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 are presented in four different sets of folders and binders: the *'Maroon' Instructor's*, the *'White' Course*, the *'Blue' Program Outcomes* and the *'Black' Educational Objectives Notebooks*. The contents of the different binders are listed *in Appendix E – Supplementary Documents*. summarized below. Textbooks, lab manuals and other course-related materials are also available during the time of the ABET review visit.

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 majors 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 in *Chemical Engineering* and *Electrical Engineering*, which greatly affected the corresponding EP concentration curricula. For those engineering subjects, some courses were eliminated, others were combined and new ones were introduced. Although not as wide-ranging, there were also 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 5.1

All EP students are required to take PHYS 213/213L or PHYS 215G/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 courses. Therefore, these courses count toward the general *Math & Science* contingent in Table 5.1.

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 PHYS 493, is required for EP students with the *Electrical Concentration.*

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 & Materials Engineering* has accepted PHYS 315 and PHYS 315L in a list of *Technical Electives* for their *Minor in Materials Engineering*. Since the PHYS 315L laboratory has stringent project reporting requirements and some project-management components, the *EP Program* accepts passing the PHYS 315L 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.

PHYS 461 is a course on *Electrostatics 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 will 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 / Materials 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 of 10 with each graduate student counting double. Our *Advanced Physics Laboratories* are accepted as *Technical Electives* for the *Minor in Materials Engineering* and the *Minor in Electrical Engineering*, thereby justifying that they have significant engineering content.

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: Course 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 the *Program Outcomes Assessment*, if such assessments have been implemented by the instructors of such courses.

The *Department of Physics* has offered a couple of *VWW* courses in recent years, such as PHYS 303V *(Energy and Society)* 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 often leads to 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 the 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 major's courses, the most common substitutions are the 9-credit rule 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.

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.

Table 5.1.a. Curriculum for Bachelor of Science in Engineering Physics – Aerospace Concentration (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 R, E or SE[1]	***Subject Area (Credit Hours)*** **Math & Basic Sciences**	**Engineering Topics** check if contains significant design (√)	**General Education**	**Other** (VWW)	**Year and, Semester, or Quarter** last two terms the course was offered:	**maximum section enrollment** for the last two terms the course was offered[2]
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 214L (or 216GL), Electricity and Magnetism Laboratory	R	1				S 2017 S 2018	21 12
ME 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

Table 5.1.a. - continued

Course (Department, Number, Title)	R, E or SE[1]	*Subject Area (Credit Hours)*				**Year and, Semester, or Quarter** last two terms	**maximum section enrollment** last two terms[2]
		Math & Basic Sciences	**Engineering Topics** significant design (√)	**General Education**	**Other** (VWW)		
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
ME 236, Engineering Mechanics I	R		3			F 2017 S 2018	48 45
ME 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
ME 237, Engineering Mechanics II	R		3			F 2017 S 2018	53 43
CE 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

Table 5.1.a. - continued

Course (Department, Number, Title)	R, E or SE[1]	***Subject Area (Credit Hours)***				**Year and, Semester, or Quarter** last two terms	**maximum section enrollment** last two terms[2]
		Math & Basic Sciences	**Engineering Topics** significant design (√)	**General Education**	**Other** (VWW)		
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
AE 339, Aerodynamics I	R		3			F 2016 F 2017	40 37
AE 362, Orbital Mechanics	R		3			F 2016 F 2017	47 46
AE 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 (18 credits)							
PHYS 462, Intermediate Electricity and Magnetism II	R		3			S 2017 S 2018	13 13
ME 345, Experimental Methods I	R		3			F 2017 S 2018	55 62
AE 363, Aerospace Structures	R		3			S 2017 S 2018	45 48
AE 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
General Education Core Elective	SE			3		F 2017 S 2018	n/a n/a

Table 5.1.a. - continued

Course (Department, Number, Title)	R, E or SE[1]	***Subject Area (Credit Hours)***				**Year and, Semester, or Quarter** last two terms	**maximum section enrollment** last two terms[2]
		Math & Basic Sciences	**Engineering Topics** significant design (√)	**General Education**	**Other** (VWW)		
Year 4, Semester 7 (15 credits)							
PHYS 454, Intermediate Modern Physics I	R	3				F 2016 F 2017	13 12
AE 419, Propulsion	R		3			F 2016 F 2017	35 37
AE 424, Aerospace Systems Engineering	R		3			S 2017 S 2018	40 38
AE 447, Aerofluids Laboratory	R		3			F 2017 S 2018	29 24
Capstone Design I (Engineering-Wide)	R		3 (√)			F 2017 S 2018	28 41
Year 4, Semester 8 (15 credits)							
PHYS 455, Intermediate Modern Physics II	R	3				S 2017 S 2018	13 12
Capstone Design II (Engineering-Wide)	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**	**63**	**25**	**6**		
TOTAL CREDIT HOURS FOR COMPLETION	**133**						
PERCENT OF TOTAL		**29.3%**	**47.4%**	**18.8%**	**4.5%**		
Total must satisfy either credit hours or percentage	**Minimum Semester Credit Hours**	**32**	**48**				
	Minimum Percentage of Total Credits Required	**25%**	**37.5%**				

Table 5.1.b. *Curriculum for Bachelor of Science in Engineering Physics – Chemical Concentration (132 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 required, elective, or a selective elective by R, E or SE[1]	***Subject Area (Credit Hours)*** **Math & Basic Sciences**	**Engineering Topics** check if contains significant design (√)	**General Education**	**Other** (VWW)	**Year and, Semester, or Quarter** last two terms the course was offered:	**maximum section enrollment** for the last two terms the course was offered[2]
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

Table 5.1.b. - continued

Course (Department, Number, Title)	R, E or SE[1]	***Subject Area (Credit Hours)*** **Math & Basic Sciences**	**Engineering Topics** significant design (√)	**General Education**	**Other** (VWW)	**Year and, Semester, or Quarter** last two terms	**maximum section enrollment** last two terms[2]
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[a)], 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

[a)]will be offered as part of CHME 303, starting Spring 2019.

Table 5.1.b. - continued

Course (Department, Number, Title)	R, E or SE[1]	*Subject Area (Credit Hours)*				**Year and, Semester, or Quarter** last two terms	**maximum section enrollment** last two terms[2]
		Math & Basic Sciences	**Engineering Topics** significant design (√)	**General Education**	**Other** (VWW)		
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

Table 5.1.b. - continued

Course (Department, Number, Title)	R, E or SE[1]	*Subject Area (Credit Hours)* **Math & Basic Sciences**	**Engineering Topics** significant design (√)	**General Education**	**Other** (VWW)	**Year and, Semester, or Quarter** last two terms	**maximum section enrollment** last two terms[2]
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
Capstone Design I (Engineering-Wide)	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 credits)							
PHYS 455, Intermediate Modern Physics II	R	3				S 2017 S 2018	13 12
Capstone Design II (Engineering-Wide)	R		3 (√)			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**	**25**	**6**		
TOTAL CREDIT HOURS FOR COMPLETION	**132**						
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**				
Total must satisfy either credit hours or percentage — **Minimum Percentage of Total Credits Required**		**25%**	**37.5%**				

Table 5.1.c. *Curriculum Bachelor of Science in Engineering Physics – Electrical Concentration (129-131 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 required, elective, or a selective elective by R, E or SE[1]	***Subject Area (Credit Hours)***				**Year and, Semester, or Quarter** last two terms the course was offered:	**maximum section enrollment** for the last two terms the course was offered[2]
		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 (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
EE 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

Table 5.1.c. - continued

Course (Department, Number, Title)	R, E or SE[1]	*Subject Area (Credit Hours)*				**Year and, Semester, or Quarter** last two terms	**maximum section enrollment** last two terms[2]
		Math & Basic Sciences	**Engineering Topics** significant design (√)	**General Education**	**Other** (VWW)		
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
EE 112, Embedded Systems	R		4			F 2017 S 2018	17 33
EE 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
EE 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

Table 5.1.c. - continued

Course (Department, Number, Title)	R, E or SE[1]	***Subject Area (Credit Hours)***				**Year and, Semester, or Quarter** last two terms	**maximum section enrollment** last two terms[2]
		Math & Basic Sciences	**Engineering Topics** significant design (√)	**General Education**	**Other** (VWW)		
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
EE 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, Intermediate Electricity & Magnetism II, or EE 351[a)] - Applied Electromagnetics	R		3-4			S 2017 S 2018	13 13
EE 312 [b)], Signals and Systems I	R		3			F 2017 S 2018	28 33
EE 380 [c)], 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

[a)]now offered under EE 340
[b)]now offered under EE 320
[c)]now offered under EE 317

Table 5.1.c. - *continued*

Course (Department, Number, Title)	R, E or SE[1]	***Subject Area (Credit Hours)*** Math & Basic Sciences	Engineering Topics significant design (√)	General Education	Other (VWW)	Year and, Semester, or Quarter last two terms	maximum section enrollment last two terms[2]
Year 4, Semester 7 (18 credits)							
PHYS 454, Intermediate Modern Physics I	R	3				F 2016 F 2017	13 12
Capstone Design I (EE 300, EE 418, or Engineering-Wide)	R		2-3 (√)			F 2017 S 2018	4 4
PHYS / EE, 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 (EE 402, EE 419, or Engineering-Wide)	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		**46**	**52-56**	**25**	**6**		
TOTAL CREDIT HOURS FOR COMPLETION	**129-131**						
PERCENT OF TOTAL		**35.7%**	**40.3%**	**19.4%**	**4.6%**		
Total must satisfy either credit hours or percentage — **Minimum Semester Credit Hours**		**32**	**48**				
Total must satisfy either credit hours or percentage — **Minimum Percentage of Total Credits Required**		**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 required, elective, or a selective elective by R, E or SE[1]	***Subject Area (Credit Hours)***				**Year and, Semester, or Quarter** last two terms the course was offered:	**maximum section enrollment** for the last two terms the course was offered[2]
		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
ME 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
ME 240, Thermodynamics	R		3			F 2017 S 2018	46 50
ENGL 111G, Rhetoric and Composition	R			4		F 2017 S 2018	27 27

Table 5.1.d. - continued

Course (Department, Number, Title)	R, E or SE[1]	*Subject Area (Credit Hours)*				Year and, Semester, or Quarter last two terms	maximum section enrollment last two terms[2]
		Math & Basic Sciences	**Engineering Topics** significant design (√)	**General Education**	**Other** (VWW)		
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
ME 236, Engineering Mechanics I	R		3			F 2017 S 2018	48 45
ME 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
ME 237, Engineering Mechanics II	R		3			F 2017 S 2018	53 43
CE 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

Table 5.1.d. - continued

Course (Department, Number, Title)	R, E or SE[1]	*Subject Area (Credit Hours)*				**Year and, Semester, or Quarter** last two terms	**maximum section enrollment** last two terms[2]
		Math & Basic Sciences	**Engineering Topics** significant design (√)	**General Education**	**Other** (VWW)		
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
ME 326, Mechanical Design	R		3			F 2017 S 2018	42 50
ME 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
ME 341, Heat Transfer	R		3			F 2017 S 2018	45 65
ME 345, Experimental Methods I	R		3			F 2017 S 2018	55 62
ME 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

Table 5.1.d. - *continued*

Course (Department, Number, Title)	R, E or SE[1]	*Subject Area (Credit Hours)* **Math & Basic Sciences**	**Engineering Topics** significant design (√)	**General Education**	**Other** (VWW)	**Year and, Semester, or Quarter** last two terms	**maximum section enrollment** last two terms[2]
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
Capstone Design I (ME 426, or Engineering-Wide)	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 (ME 427, or Engineering-Wide)	R		3 (√)			S 2017 S 2018	4 4
PHYS / ME, 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	**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**				
Total must satisfy either credit hours or percentage — **Minimum Percentage of Total Credits**		**25%**	**37.5%**				

Describe how the curriculum aligns with the program educational objectives.

The three *Program Educational Objectives* of the *EP Program* at NMSU are *Competitiveness*, *Adaptability*, and *Teamwork & Leadership*. The *Educational Objectives* of the EP Program and the methods of their evaluation are described in more detail in *Criterion 2 – Program Educational Objectives*. The objectives are consistent with the institutional educational objectives of the *College of Engineering*, the *College of Arts & Sciences*, and *New Mexico State University*.

<u>*Educational Objective 1: Competitiveness.*</u> 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. The four *EP Concentrations* require students to complete 39-49 credits of mathematics and basic sciences (including fundamental physics courses), 42-63 credit hours of engineering courses (including physics courses with significant engineering content), 25 credits of general education courses (*English*, *Communication* and *General Education Areas IV and V*), and 6 credits of *Viewing the Wider World* courses. The strong foundation of fundamental science and a broad range of specialized engineering courses help ensure that the EP graduates are competitive in internationally-recognized academic, government, and industrial environments.

<u>*Educational Objective 2: Adaptability.*</u> 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 60 fundamental-science, technical and engineering courses that cover the areas of *Physics*, *Aerospace*, *Chemical*, *Electrical*, and *Mechanical Engineering*. The wide selection of courses offered by the EP curriculum broadens the range of the potential employment opportunities for EP graduates. These opportunities include employment in R & D, energy and utility, manufacturing, automotive, photonics, aerospace, defense and space, sensor technology, and many other fields.

<u>*Educational Objective 3: Teamwork and Leadership.*</u> As a part of the EP curriculum, students are required to take several physics and engineering laboratory courses as well as the Capstone Deign course. Most of those laboratories expect students 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, and 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.

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

Program Outcomes Matrices of all physics and engineering courses for the *EP Program* are provided in Tables 3.2.a-f in *Criterion 3 – Program Outcomes*. Each course is expected to measure certain *Program Outcomes (a)-(k)*, the results of which are discussed in *Criterion 4 – Continuous Improvement.* To achieve the desired outcomes, a path of core courses (having pre-requisites) has become essential within an integrated, cumulative educational process: see flowchart 5.1.a for *Engineering Physics* with the *Aerospace Concentration*, 5.1.b with the *Chemical Concentration*, 5.1.c with the *Electrical Concentration*, and 5.1.d with the *Mechanical Concentration.*

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

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

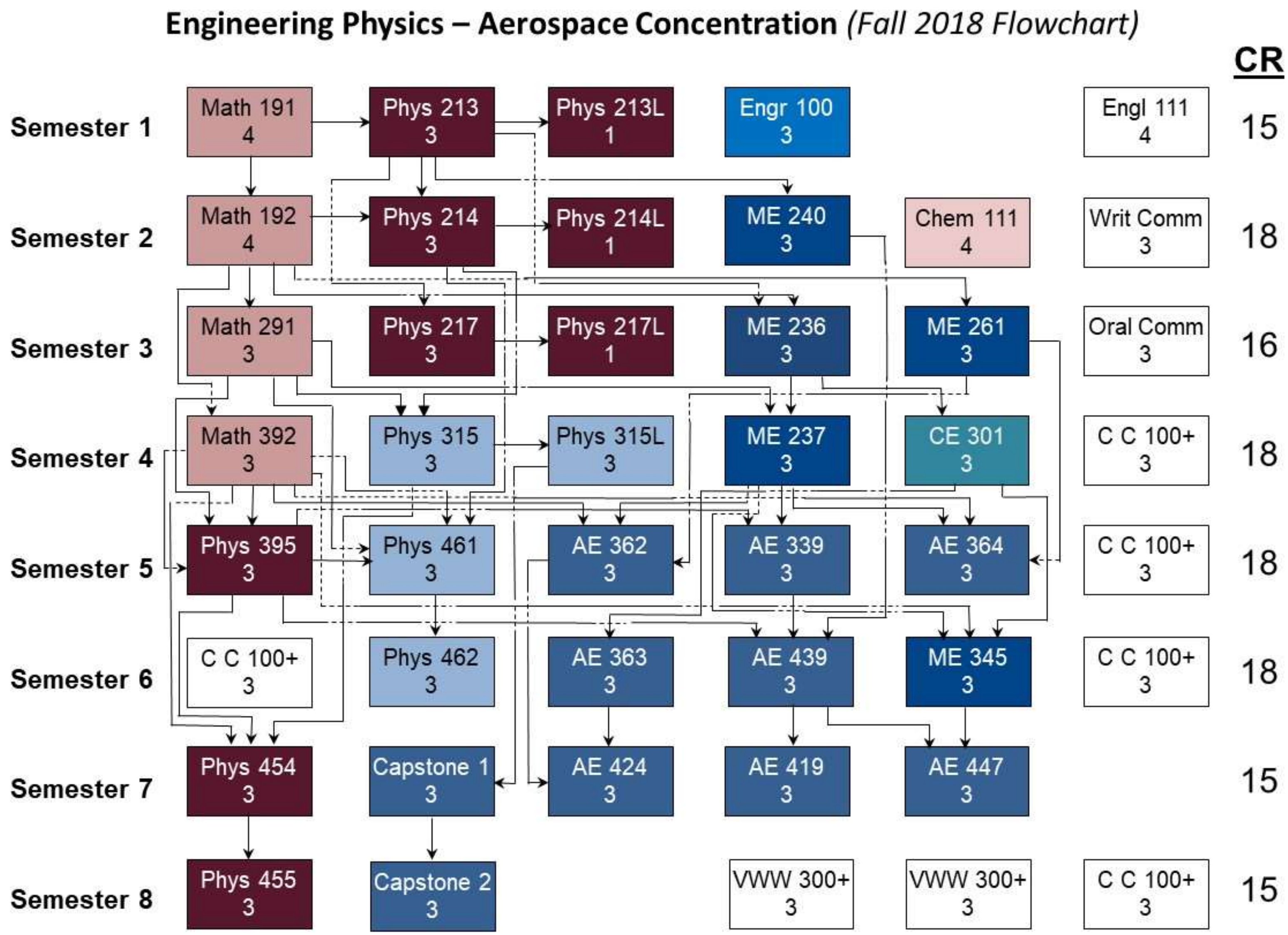


Diagram 5.1.b. *Proposed Schedule for Engineering Physics with the Chemical Concentration. Arrows coming in from the top indicate pre-requisites, arrows from the side co-requisites.*

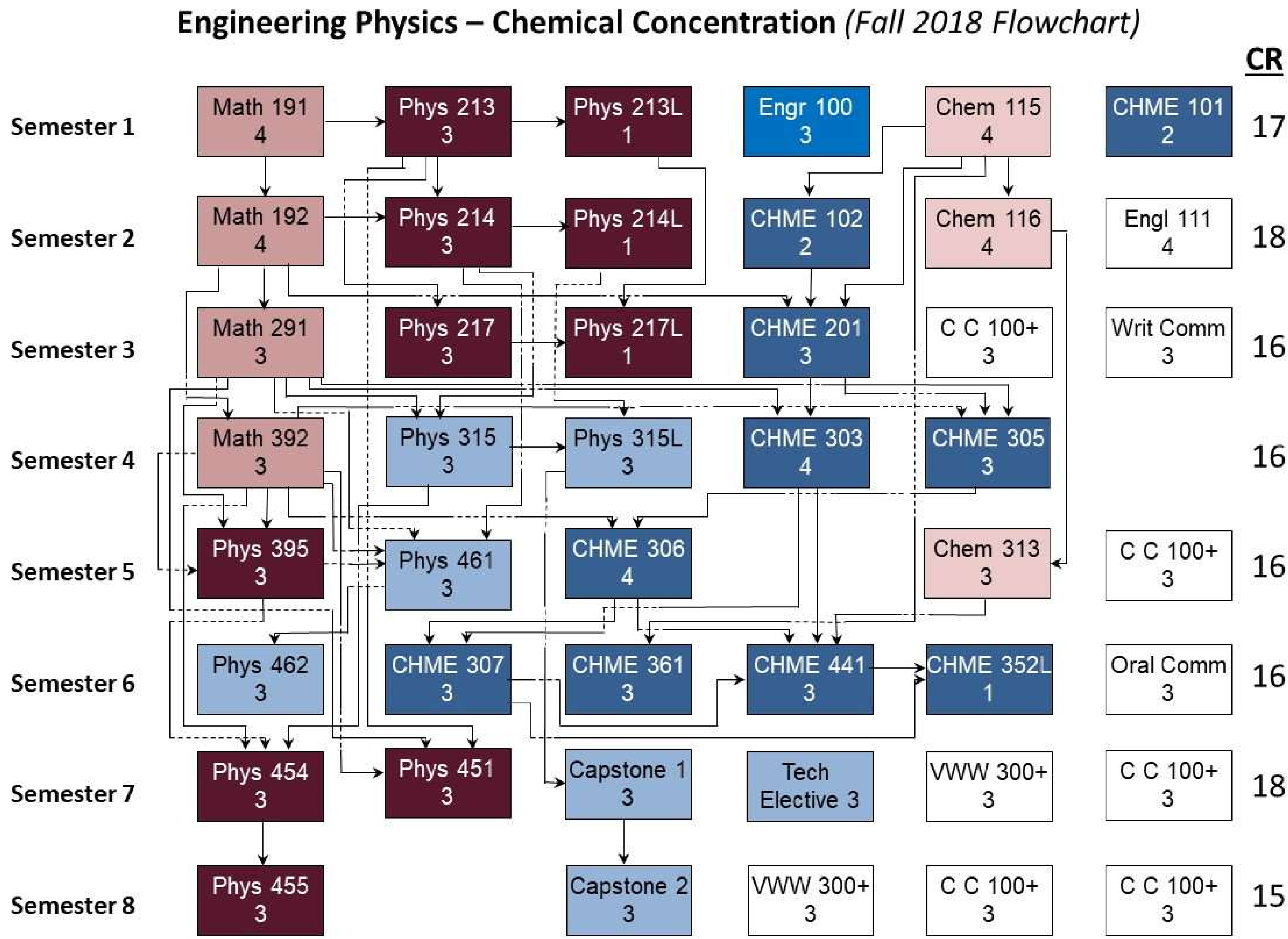
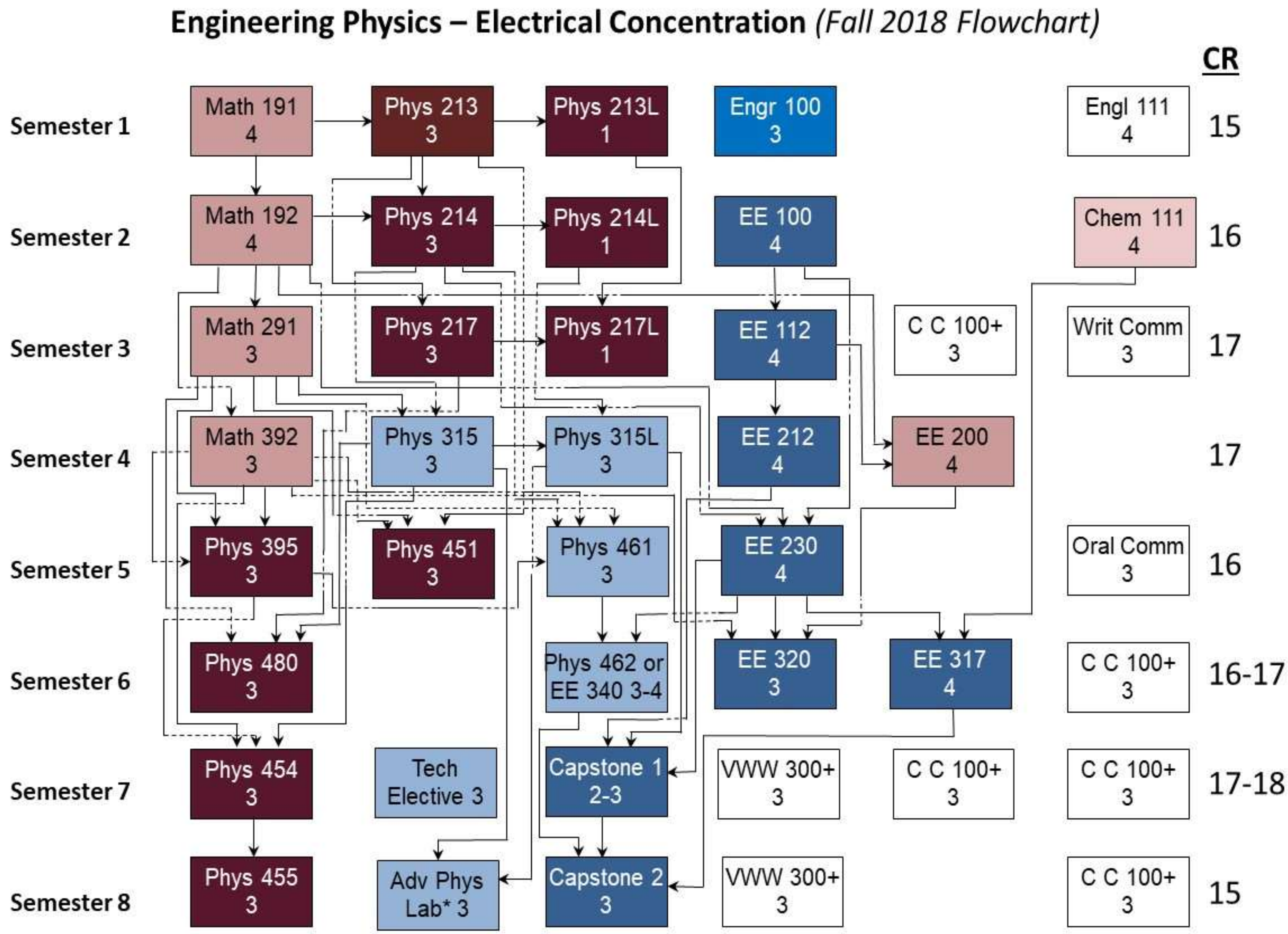
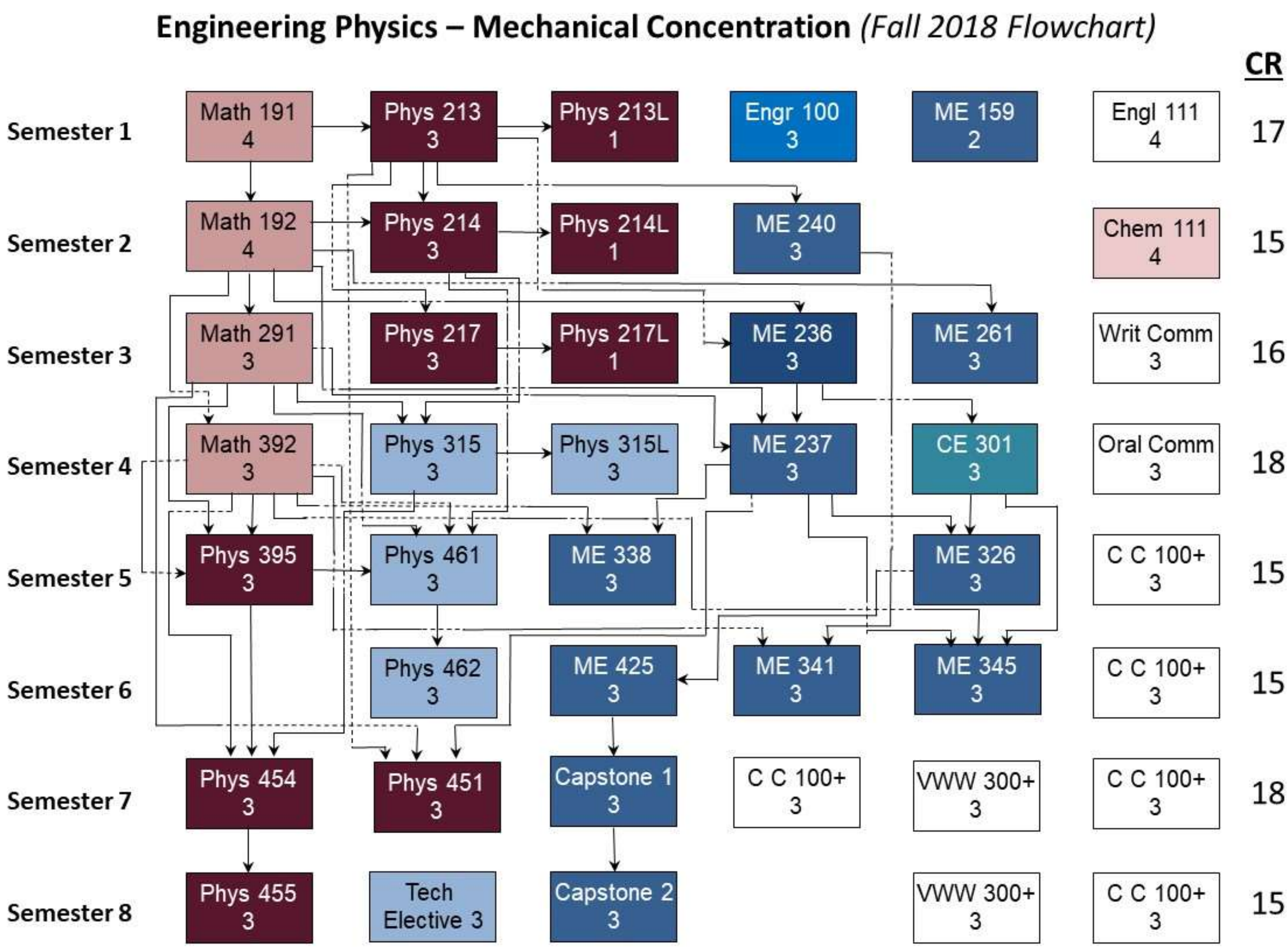


Diagram 5.1.c. *Proposed Schedule for Engineering Physics with the Electrical Concentration. Arrows coming in from the top indicate pre-requisites, arrows from the side co-requisites.*



* Phys 471, Phys 475, or Phys 493

Diagram 5.1.d. Proposed Schedule for Engineering Physics with the Mechanical Concentration. *Arrows coming in from the top indicate pre-requisites, arrows from the side 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. EP students with the *Electrical Concentration* also take EE 200, which is counted as a math course.

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, electromagnetism, thermodynamics, and advanced physics-laboratory practices. For each *EP Concentration*, 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, CHEM 111. EP students with the *Chemical concentration* are required to complete 11 credits of more advanced chemistry.

Engineering Topics

A broad-based foundation in technical and engineering courses prepares EP graduates for a variety of employment opportunities. The *EP Program* offers four concentrations: *Aerospace, Chemical*, *Electrical*, and *Mechanical*. All EP students are required to complete the ENGR 100 (*Introduction to Engineering*) course. In addition to ENGR 100, EP students with *Aerospace Concentration* must complete 16 separate aerospace engineering, mechanical and civil engineering, engineering laboratory, and *Capstone Design* courses. The *Chemical Concentration* requires students to complete 12 separate chemical engineering, engineering laboratory, and *Capstone Design* courses. The *Electrical Concentration* requires students to complete 9 (or 10) separate electrical engineering, engineering laboratory, and *Capstone Design* courses. The *Mechanical Concentration* requires students to complete 13 separate mechanical engineering, civil engineering, engineering laboratory, and *Capstone Design* courses. The selection of engineering 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: COMM 265G – *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 15 credit hours of humanities and social science electives, in addition to the courses in composition and rhetoric, technical writing, and oral communications that are mentioned above.

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

Aside from the state-wide *General Education Common Core* (GenEd) requirements, NMSU students are required to complete 6 credits of *Viewing the Wider World* courses (300+ level), typically taken in the junior or senior years. Acceptable GenEd courses and their requirements are listed in the NMSU *Undergraduate Catalog*. The *Viewing the 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 has 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 exercising *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 few seniors taking the capstones in the same semester. Moreover, 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 EP students take *Capstone Design* courses in the participating engineering departments, where sufficient enrollment is ensured due to the much larger numbers of students. While each engineering capstone consists of 3-8 students, the engineering departments offer all their capstones under one course number, thus easily escaping the 10-student minimum requirement.

The *College of Engineering* has started exploring the introduction of *College-Wide Capstone* courses that will allow students from different engineering programs (including EP) to participate in joint (and multi-disciplinary) 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 *'Maroon'* I*nstructor Notebooks* and the *'White' Course Notebook*s. The contents of both folders are listed in *Appendix E – Supplementary Documents*. In general, the folders contain general information, instructional materials 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 – Course Syllabi*.

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 Tables 6.1.a-d. The combination of physics and engineering faculty is well qualified to cover all the curricular areas of the *EP 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),
- the *Department Head* (half of the teaching load of a full-time faculty member),
- one professional staff member with responsibility for instructional support and involvement in instructional laboratory development, and
- several graduate teaching assistants with outstanding teaching skills, who may be assigned as instructor-of-record for introductory physics courses and/or instructional laboratories, usually under close supervision of the *Department Head* or another faculty member in the *Department of Physics*.

All faculty members, who teach courses needed for the *EP Program*, have a *Ph.D. in Physics*, other sciences, or engineering. The professional support staff member has a *M.S. in Physics* and a *BS in EP*. Only truly outstanding and experienced graduate assistants may be assigned as lecturers for introductory physics courses or instructors-of-record duties 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 – Faculty Vitae*. 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 served a four-year term in the *Chair line of the Forum of Industrial and Applied Physics* (FIAP) of the APS, 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 other APS committees. Dr. Zollner currently serves on a two-year term on the *Executive Committee* of the *New Mexico Chapter* of the AVS and 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. Dr. Burkardt completed a four-year term in the *Chair Line of the Topical Group on Hadronic Physics in the APS*. Dr. Mike DeAntonio has served as the *Chair of the Physics and Engineering Physics Division of the American Society for Engineering Education* (ASEE). He also served as 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. Heinz Nakotte has served a four-year term as a member of the *Executive Committee* of the *Four Corners Section* of the APS, and he was the *Conference Chair of the Joint Four Corners & Texas Sections Meeting* of the APS, which was held in Las Cruces in 2016. A NMSU physics graduate student, Samantha Sword-Fehlberg, currently serves as the student member of the *Executive Committee* of the *Four Corners Section* of the APS. Other accomplishments of faculty can be found in *Appendix B – Faculty Vitae*.

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 or other types of instructors (for example, staff or graduate-student instructor) 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.

At NMSU, a full load (100% teaching) is equivalent to eight 3-credit courses per year, i.e. each 3-credit course amounts to 12.5% of annual time commitment, if no other duties (research/scholarship and/or service/outreach) are assigned. Full-time faculty typically have some service commitments and the full teaching load at departments with no graduate program is therefore reduced to six courses per year. The teaching requirements are further reduced for faculty members, serving in departments with a graduate program, who have an active research program typically involving graduate students. In the *College of Arts & Sciences,* the nominal teaching load for tenured and tenure-track faculty of a PhD-granting department (such as the *Department of Physics*) is three formal 3-credit courses (or 9 credit hours) per year, i.e. a 37.5% teaching load. Those 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 *Physics 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. Currently, all regular (tenured) faculty members in the *Department of Physics* 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

(Drs. Edwin Fohtung, Robert Cooper, Marc Schlegel and Lauren Waszek) have bridged appointments with *Los Alamos National Lab, Department of Energy, Brookhaven National Lab* and the *Australian National University*, respectively, 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. There is no similar (fairly) uniform percentage allocation in the engineering departments and the distribution of effort is typically left to the individual *Department Heads* in the *College of Engineering*.

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*. Using the electronic *Digital Measures* system, all physics faculty members must prepare an *Annual Performance Report* (APR) for their annual evaluations. The APRs are due with the *College of Arts & Sciences* around the mid-November timeframe each year, and they are submitted to the *Physics Department Head* typically a month before that. The departmental evaluation is performed by a committee consisting of two tenured physics 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. Research and other scholarly activities are evaluated based on the 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 APRs, faculty of graduate-degree granting departments are also evaluated every 3 to 5 years by the *Graduate School* for membership on the graduate faculty. The primary criteria for retaining graduate-faculty membership status 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 fall, spring and summer semesters. To increase elective opportunities for students, some courses are taught jointly between physics and engineering departments, for example *Introduction to Nanotechnology* (jointly with *Chemical & Materials Engineering*), *Optics* (jointly with *Electrical & Computer Engineering*), and *Modern Materials or Intermediate X-ray Diffraction* (jointly with *Chemical & Materials Engineering*, but taught in *Physics*).

Senior Student Exit Interviews usually show that students are 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 currently shared by three *Engineering Physics Advisors* (Drs. Tom Hearn, Heinz Nakotte and Steve Pate).

Six faculty members (Drs. Robert Cooper, Mike DeAntonio, Edwin Fohtung, Boris Kiefer and Lauren Waszek) serve or have served as faculty advisors for the two student societies, the *Society of Physics Students (SPS)* and the *Society for Engineering Physics (SEPh)*. Both societies are actively involved in the department's outreach, recruitment and retention activities. Each society has weekly meetings (sometimes jointly), usually in the evening. The societies help to develop important skills (resume writing, applying for graduate school, taking standardized tests) and review opportunities for jobs and internships. The *Department of Physics* promotes and often supports the activities of both societies (e.g. by paying for the pizza provided at their meetings, by providing travel support for excursions to near-by research facilities, or by purchasing materials needed for demonstration set-ups). Moreover, some of their meetings are reserved for students to report on their undergraduate research or capstone projects, moderated by a faculty advisor.

A substantial fraction of faculty members in the *Department of Physics* perform theoretical research or experimental off-campus research (particularly at national laboratories, such as *Los Alamos National Laboratory, Brookhaven National Laboratory, Oak Ridge National Laboratory* and *Fermi National Accelerator Lab*). Only few faculty members (Drs. Robert Cooper, Edwin Fohtung, Jacob Urquidi and Stefan Zollner) have on-campus physics research laboratories, and 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. Therefore, EP students typically fulfill their *Capstone Design* requirement utilizing research facilities that are available in the engineering departments.

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 Laboratory, 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 (more than 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 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 Research* (PER). Most of our faculty members attend PER 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 in meetings with individual faculty or with groups of faculty members. Finally, development opportunities for faculty are offered by the *NMSU Teaching Academy*. Topics of their courses include engagement of students through active teaching methods, online 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 this: a) the number of EP students itself is too low (39 students in

Fall 2017) to meet the minimum-enrollment requirement of 10 students required undergraduate courses, and b) the participating departments lack the personnel strengths to teach additional courses. Tables 6.2 lists only the physics and engineering courses that have been (or could have been) taken by EP students to fulfill courses that are required for the EP degree or could have served as a suitable elective. Since the number of EP students is small, the larger fraction of enrolled students in these courses were typically other engineering or physical science (including physics) majors.

We used the following scheme to estimate of the time devoted to the *EP Program* by individual faculty members from the different departments (Table 6.2.a-d):

- Given that NMSU considers one 3-credit course as 12.5% of annual time commitment and physics courses are taken by physics and EP majors (with similar enrollments), we count **2% per credit hour** (~12.5 divided by 3 credit hours and divided by two majors, rounded down to next integer) taught for a course relevant to EP. 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 engineering courses, the faculty member received only half, i.e. **1 % per credit hour**, since none of those courses has any EP-specific assessment requirements.
- Service on the *Engineering Physics Program Committee* counts as follows: **8% for the Chair** (Dr. Nakotte), **4% for members** (Drs. DeAntonio, Hearn, Luo, Pate, Shu, Stochaj, Vasiliev, Zollner)
- The *EP Program* works closely with other committees that are critical to the success of the program, such as the *Curriculum Committee* (**8% for the Chair**, Dr, Vasiliev), the *Laboratory Committee* (**4% for the Chair**, Dr, Pate), and the Computer Committee (**4% for the Chair**, Dr. Engelhardt).
- The time commitment for EP student advising was estimated at **5%** (Drs. Hearn, Nakotte and Pate),
- Faculty received **3%**, if the served as advisors/mentors to SEPh (Drs. DeAntonio, Kiefer, Nakotte).
- All physics faculty will participate in the outcomes reviews and summaries, i.e. **2%** was added to faculty not part of any the above committees and not involved in advising.

The resulting percentages are presented in the last columns of Table 6.2.a-d. It does not include advising of student in research (graduate or undergraduate) or teaching courses that are not relevant to the EP degree (e.g. graduate courses, 100-level physics courses, 200-level courses for non-science majors). 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 are periodic assessment meetings (every 1-2 years), where the faculty summarize the results of *Program Outcomes* measurements 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. Several faculty members contributed to the writing of this *ABET Self-Study Report (*SSR).

Compliance of a faculty member's expected contributions related to program accreditation is an important measure for the individual's *Annual Performance Appraisal* by the *Physics Department Head*. Usually, almost all physics faculty members meet expectations with their contributions to the *EP Program*. The *Associate Deans for Academics* in both colleges work with the *Physics Department Head* to encourage compliance with institutional and *ABET Assessment Deliverables*. 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.

The *Deans of the College of Arts & Sciences* and the *Deans of the College of Engineering* meet with the *Engineering Physics External Advisory Board* (EPEAB) during their on-campus visits. (This is common for all annual board meetings.) *Deans* and *Associate Deans* of 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 their respective *Student Ambassador Programs* with the goal to better recruit and retain students and to enhance the participation of students in STEM disciplines and their programs.

Table 6.1.a. Faculty Qualifications – Department of Physics, Bachelor of Science in Engineering Physics

Faculty, Instructor or Staff Name	Highest Degree Earned- Field and Year	Rank [1]	Type of Academic Appointment[2] T, TT, NTT	FT or PT[3]	Years of Experience			Professional Registration/ Certification	Level of Activity[4] 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

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.a. *- continued*

Faculty, Instructor or Staff Name	Highest Degree Earned- Field and Year	Rank [1]	Type of Academic Appointment[2] T, TT, NTT	FT or PT[3]	Years of Experience			Professional Registration/ Certification	Level of Activity[4] H, M, or L		
					Govt./Ind. Practice	Teaching	This Institution		Professional Organizations	Professional Development	Consulting/summer work in industry
Vassilios Papavassiliou	Ph.D. Physics 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

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.a. *- continued*

Faculty, Instructor or Staff Name	Highest Degree Earned- Field and Year	Rank [1]	Type of Academic Appointment[2] T, TT, NTT	FT or PT[3]	Years of Experience			Professional Registration/ Certification	Level of Activity[4] H, M, or L		
					Govt./Ind. Practice	Teaching	This Institution		Professional Organizations	Professional Development	Consulting/summer work in industry
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
Francisco Carreto-Parra	MS Physics 2007	O	NTT	FT	4	10	1	NA	M	M	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

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 Appointment[2] T, TT, NTT**	**FT or PT[3]**	**Years of Experience**			**Professional Registration/ Certification**	**Level of Activity[4] H, M, or L**		
					Govt./Ind. Practice	**Teaching**	**This Institution**		**Professional Organizations**	**Professional Development**	**Consulting/summer work in industry**
Abdessattar Abdelkefi	Ph.D. Engineering Mechanics 2012	AST	TT	FT	0	4	4	None	M	M	L
Vimal Chaitanya	Ph.D. Materials Science and Engineering 1984	P	T	FT	4	33	11	None	H	M	L
Ruey-Hung Chen	PhD. Aerospace Engineering 1988	P	T	FT	3	26	3	None	M	L	L
Vincent Choo	Ph.D. Composite Materials 1982	ASC	T	FT	0	32	32	None	L	L	L
Edgar Conley	Ph.D. Engineering Mechanics 1986	ASC	T	FT	1	32	30	PE (MI)	M	L	L
Borys Drach	Ph.D. Mechanical Engineering, 2013	AST	TT	FT	0	5	5	None	M	L	L
Gabriel Garcia	Ph.D. Mechanical Engineering 1996	ASC	T	FT	0	22	22	None	L	L	L
Andreas Gross	PH.D. Mechanical Engineering 2002	AST	TT	FT	0	8.5	4.5	None	M	L	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 6.1.b. *- continued*

Faculty Name	Highest Degree Earned- Field and Year	Rank [1]	Type of Academic Appointment[2] T, TT, NTT	FT or PT[3]	Years of Experience			Professional Registration/ Certification	Level of Activity[4] H, M, or L		
					Govt./Ind. Practice	Teaching	This Institution		Professional Organizations	Professional Development	Consulting/summer work in industry
Krishna Kota	Ph.D. Mechanical Engineering, 2008	AST	TT	FT	2	5	5	None	M	L	L
Sarada Kuravi	Ph.D. Mechanical Engineering 2009	AST	TT	FT	0	5	3	None	M	L	L
Young Sup Lee	Ph.D. Mechanical Engineering 2006	ASC	T	FT	0	12	10	None	M	M	M
Hyeongjun Park	Ph.D. Aerospace Engineering 2014	AST	TT	FT	0	0	0	None	M	M	L
Young Ho Park	PhD. Mechanical Engineering 1994	ASC	T	FT	2	17	17	None	M	M	L
Igor Sevostianov	Ph.D. Solid Mechanics 1993	P	T	FT	0	24	16	None	M	L	H
Banavara Shashikanth	Ph.D. Aerospace Engineering 1998	ASC	T	FT	2	18	18	None	L	M	L
Fangjun Shu	Ph.D. Mechanical Engineering 2005	ASC	T	FT	0	7	7	None	L	L	L
Liang Sun	Ph.D. Electrical and Computer Engineering 2012	AST	TT	FT	0	5	2	None	H	H	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 6.1.c. Faculty Qualifications – Department of Electrical & Computer Engineering

Faculty Name	Highest Degree Earned- Field and Year	Rank [1]	Type of Academic Appointment[2] T, TT, NTT	FT or PT[3]	Years of Experience			Professional Registration/ Certification	Level of Activity[4] H, M, or L		
					Govt./Ind. Practice	Teaching	This Institution		Professional Organizations	Professional Development	Consulting/summer work in industry
Abdel-Hammeed Badawy	Ph.D. Computer Engineering 2013	AST	TT	FT	0	5	2	None	L	L	None
Charles Boehmer	Ph.D. 1973	A	NTT	FT	39	12	12	None	None	None	None
Devah K. Borah	PhD. Telecommunications Engineering 2000	P	T	FT	0	25	18	None	M	H	L
Laura Boucheron	Ph.D. Electrical and Computer Engineering 2008	ASC	T	FT	2	7	7	None	L	H	None
Sikumar Brama	Ph.D. Electrical Engineering 2001	ASC	T	FT	2	9	5	None	H	H	N
Sang-Yeon Cho	Ph,D, Electrical and Computer Engieneering2002	ASC	T	FT	0	5	5	None	M	H	None
Charles D. Creusere	Ph.D. Electrical and Computer Engineering 1983	P	T	FT	10	11	11	None	H	H	L
Muhammad Dawood	Ph.D. Electrical Engineering 2001	ASC	T	FT	6	14	7	None	L	M	None

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. *– continued*

Faculty Name	Highest Degree Earned- Field and Year	Rank [1]	Type of Academic Appointment[2] T, TT, NTT	FT or PT[3]	Years of Experience			Professional Registration/ Certification	Level of Activity[4] H, M, or L		
					Govt./Ind. Practice	Teaching	This Institution		Professional Organizations	Professional Development	Consulting/summer work in industry
Phillip De Leon	Ph.D. Electrical Engineering 1995	P	T	FT	0	16	16	None	L	M	M
Paul M Furth	Ph.D. Electrical Engineering 1996	ASC	T	FT	5	17	17	None	L	L	L
Hong Huang	Ph.D. Electrical and Computer Engineering 2002	ASC	T	FT	11	17	15	None	M	M	L
David Mitchell	PhD. Electrical Engineering2009	AST	TT	FT	0	8	3	None	M	H	L
Kwong T. Ng	Ph.D. Electrical Engineering 1985	P	T	FT	0	27	21	None	L	H	L
Krist A. Peterson	Ph.D. Electrical Engineering 1997	ASC	NTT	FT	2	26	26	None	None	None	None
Nadipuram Prasad	Ph,D, Electrical Engineering1989	ASC	T	FT	15	26	26	None	L	M	None
Jaime Ramirez-Anguelo	Ph.D. Electrical Engineering 1982	P	T	FT	2.5	36	28	None	M	L	M
Sattishkumar J. Ranade	Ph.D. Electrical Engineering 1981	P	T	FT	2	31	31	None	H	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. *– continued*

Faculty Name	Highest Degree Earned- Field and Year	Rank [1]	Type of Academic Appointment[2] T, TT, NTT	FT or PT[3]	Years of Experience			Professional Registration/ Certification	Level of Activity[4] H, M, or L		
					Govt./Ind. Practice	Teaching	This Institution		Professional Organizations	Professional Development	Consulting/summer work in industry
Steven Sandoval	Ph.D. Electrical Engineering 2016	AST	TT	FT	5	2	2	None	M	L	L
Steven J. Stochaj	Ph.D. Physics 1990	P	T	FT	2	26	21	None	M	H	None
Wei Tang	PhD. Electrical Engineering 2012	AST	TT	FT	0.5	6	6	None	M	M	M
David Voelz	Ph.D. Electrical Engineering 1987	P	T	FT	14	16	16	None	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.d. *Faculty Qualifications – Department of Chemical & Materials Engineering*

Faculty Name	Highest Degree Earned- Field and Year	Rank [1]	Type of Academic Appointment[2] T, TT, NTT	FT or PT[3]	Years of Experience			Professional Registration/ Certification	Level of Activity[4] 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	0	5	5	MA bar	H	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 6.1.d. - *continued*

Faculty Name	Highest Degree Earned- Field and Year	Rank [1]	Type of Academic Appointment[2] T, TT, NTT	FT or PT[3]	Years of Experience: Govt./Ind. Practice	Years of Experience: Teaching	Years of Experience: This Institution	Professional Registration/ Certification	Level of Activity[4] H, M, or L: Professional Organizations	Level of Activity[4] H, M, or L: Professional Development	Level of Activity[4] H, M, or L: Consulting/summer work in industry
Martha Mitchell	Ph.D. Chemical Engineering 1996	P	T	FT	0	20	20	PE, NAFI CFEI, OSHA	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. Nuclear Physics 1975	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/Instructor Workload Summary – Department of Physics. Percentage time devoted to the program for full-time employees (full-time faculty and staff) reflects percentage of time spend on EP Program in Spring 2017, Fall and Summer2018. Percentage time devoted to program for part-time faculty (college faculty and graduate-student instructors) reflects percentage of time spend during employment period.*

Faculty or Instructor Name	PT or FT[1]	Classes Taught (Course No./Credit Hrs.) Term and Year[2]	Program Activity Distribution[3]			% of Time Devoted to the Program[5]
			Teaching	***Research or Scholarship***	***Other[4]***	
Matthias Burkardt	FT	Spring 2018 - PHYS 315 (3), PHYS455 (3)	25	65	10	16
Francisco Carreto-Parra	FT	Summer 2018 - PHYS 215GL (1) PHYS 216GL (1)	80	0	20	4
Robert Cooper	FT	Spring 2018 - PHYS 462 (3)	15	79	6	8
Michael Engelhardt	FT	Fall 2017 - PHYS 213 (3), PHYS 495 (3), PHYS 454 (3)	45	45	10	22
Edwin Fohtung	FT	Spring 2018 - PHYS 303V (3)	18	70	12	8
Thomas Hearn	FT	Fall 2017 - PHYS 305V (3) Spring 2018 - PHYS 215G (3), PHYS 215GL (1)	45	45	10	23
Boris Kiefer	FT	Spring 2018 - PHYS 476 (3)	35	60	5	11
Heinz Nakotte	FT	Fall 2017 - PHYS 461 (3), PHYS 216GL (1) Spring 2018 - PHYS 216G (3) Summer 2018 – PHYS 216G (3)	40	40	20	46

[1]FT = Full Time Faculty or PT = Part Time Faculty, at the institution
[2]For the academic year for which the self-study is being prepared (2017/18 academic year).
[3]Program activity distribution should be in percent of effort in the program and should total 100%. Figures are for 2017/18 academic year.
[4]Indicate sabbatical leave, etc., under "Other."
5Out of the total time employed at the institution (see text for explanation).

Table 6.2.a. - *continued.*

Faculty or Instructor Name	PT or FT[1]	Classes Taught (Course No./Credit Hrs.) Term and Year[2]	Program Activity Distribution[3]			% of Time Devoted to the Program[5]
			Teaching	*Research or Scholarship*	*Other[4]*	
Stephen Pate	FT	Fall 2017 - PHYS 215G (3) Spring 2018 - PHYS 480 (3), PHYS 315L (3)	40	50	10	31
Marc Schlegel	FT	None	20	75	5	2
Jacob Urquidi	FT	Fall 2017 - PHYS 395 (3) Spring 2018 - PHYS 475 (3), PHYS 216G (3)	60	30	10	20
Igor Vasiliev	FT	None	42.5	47.5	10	12
Lauren Waszek	FT	Fall 2017 - PHYS 451 (3), PHYS 216G (3) Spring 2018 - PHYS 216G (1)	45	50	5	16
Stefan Zollner	FT	Fall 2017 - PHYS 468 (3), PHYS 213L (1) Spring 2018 PHYS 214L (1), PHYS 489 (3)	30	15	55 (DH)	20
Michaela Burkardt	PT	Fall 2017 - PHYS 217 (3), PHYS 217L (1), PHYS 280 (1) Spring 2018 - PHYS 214 (3), PHYS 204 (1)	95	0	5	40
Michael De Antonio	PT	Spring 2018 - PHYS 215G (3)	90	0	10	26

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

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

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

[4]Indicate sabbatical leave, etc., under "Other."

5Out of the total time employed at the institution (see text for explanation).

Table 6.2.a. - continued.

Faculty or Instructor Name	PT or FT[1]	Classes Taught (Course No./Credit Hrs.) Term and Year[2]	Program Activity Distribution[3]			% of Time Devoted to the Program[5]
			Teaching	*Research or Scholarship*	*Other[4]*	
Farzin Abadizaman	PT	Summer 2018 - PHYS 215G (3)	100	0	0	50
Fatma Aslan	PT	Fall 2017 - PHYS 216G (3) Spring 2018 - PHYS 380 (1)	55	45	0	50
Federico Alvarez	PT	Fall 2017 - PHYS 203 (1), PHYS 205 (1), PHYS 206 (1)	100	0	0	50
Galen Helms	PT	Fall 2017 - PHYS 215GL (1)	100	0	0	25
Greggory McPherson	PT	Fall 2017 - PHYS 215G (3)	100	0	0	50

[1]FT = Full Time Faculty or PT = Part Time Faculty, at the institution
[2]For the academic year for which the self-study is being prepared (2017/18 academic year).
[3]Program activity distribution should be in percent of effort in the program and should total 100%. Figures are for 2017/18 academic year.
[4]Indicate sabbatical leave, etc., under "Other."
5Out of the total time employed at the institution (see text for explanation).

Table 6.2.b. *Faculty/Instructor Workload Summary – Department of Mechanical & Aerospace Engineering. Percentage time devoted to the program for full-time faculty) reflects percentage of time spend on EP Program in Spring 2017, Fall and Summer2018. Percentage time devoted to program for part-time faculty (college instructors) reflects percentage of time spend during employment period. Courses taught by graduate-student instructors are not included.*

Faculty or Instructor Name	**PT or FT[1]**	**Classes Taught (Course No./Credit Hrs.) Term and Year[2]**	**Program Activity Distribution[3]**			**% of Time Devoted to the Program[5]**
			Teaching	***Research or Scholarship***	***Other[4]***	
Abdessattar Abdelkefi	FT	Fall 2017 – ME 333 (3) Spring 2018 – ME 237 (3)	45	50	5	6
Vimal Chaitanya	FT	Spring 2018 – ME 236 (3)	50	20	30	3
Ruey-Hung Chen	FT	Fall 2017 – AE 419 (3)	25	25	50 (DH)	3
Vincent Choo	FT	Fall 2017 – ME 335 (3), ME 237 (3) Spring 2018 – ME 345 (3), ME 240 (3)	50	30	20	12
Edgar Conley	FT	Fall 2017 – ME 326 (3), ME 425 (3), ME 449 (1)	50	30	20	7
Borys Drach	FT	Fall 2017 – ME 236 (3) Spring 2018 – ME 236 (3) Summer 2018 – ME 234 (3)	50	45	5	9
Gabriel Garcia	FT	Fall 2017 – ME 261 (3) Spring 2018 – ME 261 (3), ME 460 (3) Summer 2018 – ME 261 (3), ME 460 (3)	50	20	30	15

[1]FT = Full Time Faculty or PT = Part Time Faculty, at the institution
[2]For the academic year for which the self-study is being prepared (2017/18 academic year).
[3]Program activity distribution should be in percent of effort in the program and should total 100%. Figures are for 2017/18 academic year.
[4]Indicate sabbatical leave, etc., under "Other."
5Out of the total time employed at the institution (see text for explanation).

Table 6.2.b. - continued.

Faculty or Instructor Name	PT or FT[1]	Classes Taught (Course No./Credit Hrs.) Term and Year[2]	Program Activity Distribution[3]			% of Time Devoted to the Program[5]
			Teaching	*Research or Scholarship*	*Other[4]*	
Andreas Gross	FT	Fall 2017 – AE 451 (3)	45	50	5	3
Krishna Murty Kota-Venkata	FT	Fall 2017 – ME 240 (3), ME 341 (3) Spring 2018 – ME 341 (3) Summer 2018 – ME 341 (3)	50	45	5	6
Sarada Kuravi	FT	Fall 2017 – ME 340 (3), ME 481 (3) Spring 2018 – ME 340 (3), ME 481 (3) Summer 2018 – ME 340 (3)	50	45	5	15
Young S. Lee	FT	Fall 2017 – AE 364 (3), ME 328 (3) Spring 2018 – AE 363 (3), AE 405 (3)	45	40	15	12
Hyeongjun Park	FT	none	45	50	5	0
Young-Ho Park	FT	Fall 2017 – ME 426 (3), ME 427 (3) Spring 2018 – ME 426 (3), ME 427 (3) Summer 2018 – ME 426 (3), ME 427 (3)	50	40	10	18
Igor Sevostianov	FT	Spring 2018 – ME 331 (3)	45	45	10	3

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

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

[4]Indicate sabbatical leave, etc., under "Other."

5Out of the total time employed at the institution (see text for explanation).

Table 6.2.b. - continued.

Faculty or Instructor Name	PT or FT[1]	Classes Taught (Course No./Credit Hrs.) Term and Year[2]	Program Activity Distribution[3]			% of Time Devoted to the Program[5]
			Teaching	*Research or Scholarship*	*Other[4]*	
Banavara Shashikanth	FT	Fall 2017 – ME 240 (3), ME 328 (3) Spring 2018 – ME 240 (3), ME 328 (3)	45	45	10	12
Fangjun Shu	FT	Fall 2017 – AE 339 (3), AE 447 (3) Spring 2018 – AE 439 (3), AE 447 (3)	50	35	15	16
Liang Sun	FT	Fall 2017 – ME 210 (3) Spring 2018 – ME 210 (3), ME 487 (3)	50	40	10	9
Terry Armstrong	PT	Fall 2017 – ME 228 (3), ME 445 (3) Spring 2018 – AE 424 (3), ME 228 (3), ME 445 (3)	100	0	0	15

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

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

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

[4]Indicate sabbatical leave, etc., under "Other."

5Out of the total time employed at the institution (see text for explanation).

Table 6.2.c. *Faculty/Instructor Workload Summary – Department of Electrical & Computer Engineering. Percentage time devoted to the program for full-time faculty) reflects percentage of time spend on EP Program in Spring 2017, Fall and Summer2018. Percentage time devoted to program for part-time faculty (college instructors) reflects percentage of time spend during employment period. Courses taught by graduate-student instructors are not included.*

Faculty or Instructor Name	PT or FT[1]	Classes Taught (Course No./Credit Hrs.) Term and Year[2]	Program Activity Distribution[3]			% of Time Devoted to the Program[5]
			Teaching	*Research or Scholarship*	*Other[4]*	
Abdel Badawy	FT	Spring 2018 – EE 212 (4)	35	55	10	4
Deva Borah	FT	Fall 2017 – EE 200 (4) Spring 2018 – EE 314 (4)	50	35	15	8
Charles Boehmer	PT	Fall 2017 – EE 461 (3) Spring 2018 – EE 460 (3)	100	0	0	6
Laura Boucheron	FT	Fall 2017 - EE 314 (4), EE395 (3)	50	40	10	7
Sukumar Brahma	FT	Fall 2017 - EE 230 (4), EE 431(3)	45	40	15	7
Sang-Yeon Cho	FT	Fall 2017 - EE 425 (3) Spring 2018 – EE 230 (4), EE 380 (4)	35	60	5	11
Charles Creusere	FT	Fall 2017 - EE 312 (3), EE 418 (3) Spring 2018 – EE 200 (4)	25	50	25	10
Muhammad Dawood	FT	Fall 2017 -EE 351 (4) Spring 2018 – EE 240 (4), EE 310 (4)	30	60	10	12
Philip DeLeon	FT	Spring 2018 – EE 443 (3)	13	25	62	3
Paul Furth	FT	Fall 2017 - EE 100 (4) Spring 2018 – EE 100 (4), EE 112 (4) Summer 2018 – EE 314 (3), EE 418 (3), EE 419 (3)	55	35	10	21

Table 6.2.c. *- continued*

Faculty or Instructor Name	PT or FT[1]	Classes Taught (Course No./Credit Hrs.) Term and Year[2]	Program Activity Distribution[3]			% of Time Devoted to the Program[5]
			Teaching	***Research or Scholarship***	***Other***[4]	
Hong Huang	FT	Fall 2017 - EE 112 (4), EE 469 (3)	35	55	10	7
David Mitchell	FT	none	25	70	5	0
Kwong Ng	FT	Fall 2017 - EE 310 (3) Spring 2018 – EE 351 (3)	50	40	10	6
Krist Petersen	PT	Fall 2017 - EE 161 (4) Spring 2018 – EE 162 (4), EE 363 (4)	100	0	0	12
Nadipuram Prasad	FT	Fall 2017 - EE 201 (3)	45	45	10	3
Jaime Ramirez-Angulo	FT	Fall 2017 -EE 380 (4), EE 482 (3) Spring 2018 – EE 380 (4)	30	60	10	11
Satish Ranade	FT	Fall 2017 - EE 280 (4), EE 418 (3) , EE 419 (3) Spring 2018 – EE 280 (4), EE 418 (3), EE 419 (3)	45	35	20	20
Steven Sandoval	FT	Fall 2017 - EE312 (3) Spring 2018 – EE 312 (3)	45	25	30	5
Steven Stochaj	FT	Fall 2017 - EE100 (3) two sections Spring 2018 – EE 418 (3), EE 419 (3), EE 460 (3)	30	40	30	20
Wie Tang	FT	none	40	40	20	0
David Voelz	FT	none	30	60	10	0

Table 6.2.d. *Faculty/Instructor Workload Summary – Department of Chemical & Materials Engineering. Percentage time devoted to the program for full-time faculty) reflects percentage of time spend on EP Program in Spring 2017, Fall and Summer2018. Percentage time devoted to program for part-time faculty (college instructors) reflects percentage of time spend during employment period. Courses taught by graduate-student instructors are not included.*

Faculty or Instructor Name	**PT or FT[1]**	**Classes Taught (Course No./Credit Hrs.) Term and Year[2]**	**Program Activity Distribution[3]**			**% of Time Devoted to the Program[5]**
			Teaching	***Research or Scholarship***	***Other[4]***	
Paul Andersen	FT	Fall 2017 – CHME 452 (3), CHME 470(3) Summer 2018 - CHME 361 (3)	25	20	55	9
Catherine Brewer	FT	Fall 2017 - CHME 306 (4); Spring 2018 - CHME 301 (3), CHME 495 (2)	43.8	51.3	5	10
Reza Foudazi	FT	Fall 2017 – CHME 361 (3) Spring 2018 – CHME 305 (3)	37.5	57.5	5	6
Jessica Houston	FT	Fall 2017 – CHME 412 (3)	12.5	32.5	55	7
Hongmei Luo	FT	Fall 2017 - CHME 302 (2), CHME 467 (3)	20.8	74.2	5	5
Thomas Manz	FT	Spring 2018 – CHME 307 (3), CHME 461 (3)	37.5	57.5	5	6
Martha Mitchell	FT	Spring 2018 – CHME 102 (2), CHME 392 (3)	33.3	11.7	55	5
David Rockstraw	FT	Fall 2017 – CHME 101 (2), CHME 391 (1) Summer 2018 - CHME 101 (2), ENGR 100 (3)	12.5	17.5	70 (DH)	8
Daniel Gulino	PT	Fall 2017 - CHME 323L (1), CHME 423L (1) Spring 2018 - CHME 324L (1), CHME 424L (1)	100	0	0	4

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[4]Indicate sabbatical leave, etc., under "Other."
5Out of the total time employed at the institution (see text for explanation).

Table 6.2.d. - continued

Faculty or Instructor Name	PT or FT[1]	Classes Taught (Course No./Credit Hrs.) Term and Year[2]	Program Activity Distribution[3]			% of Time Devoted to the Program[5]
			Teaching	*Research or Scholarship*	*Other[4]*	
Juanita Miller	PT	Spring 2018 – CHME 449 (3)	100	0	0	3
Ila Pillamarri	PT	Spring 2018 - CHME 471 (3)	100	0	0	3
Alicia Salazar	PT	Fall 2017 – CHME 491 (3)	100	0	0	3
Neda Sanatkaran	PT	Spring 2018 - CHME 361 (3)	12.5	82.5	0	3
John Schutte	PT	Fall 2017 - CHME 302L (1), CHME 452L (1) Spring 2018 - CHME 352L (1), CHME 455 (3), CHME 455L (1)	25	75	0	7

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

[4]Indicate sabbatical leave, etc., under "Other."

5Out of the total time employed at the institution (see text for explanation).

CRITERION 7. FACILITIES

Sections A thru D describe only describe the facilities in the *Department of Physics*. The *Engineering Departments* participating in the *EP Program* have their own *Criterion7 – Facilities* sections, which are described in their respective Self Study Reports.

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 based in room GN 221, *Gardiner Hall*, near 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 students 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* (completed in 2010), 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 lecture classes in four classrooms in *Gardiner Hall*. All four classrooms have multi-media capabilities, including ceiling-mounted projectors, large screens, CD players, and document cameras. Most 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, GN 230, seats about 110 students; this classroom is used for the large engineering classes, such as PHYS 215G and 216G. The next largest, GN 229, seats about 65 students; this is used for the smaller more intensive classes PHYS 213, 214, 217, and 315. GN 218A, which seats about 24 students, is used for upper-division classes like PHYS 454, 455, 461, 462, 480, 489, etc. GN 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, GN 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, GN 131 and 132, which are about 800 sq. ft. in size. The *Advanced Physics Laboratories*, PHYS471 (Optics), PHYS 475 (Materials) and PHYS493 (Nuclear Physics) are operated in several laboratory spaces throughout *Gardiner Hall*, some of which may be also research laboratories and/or part of 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 PHYS 315L and the 400-level *Advanced Physics Laboratories*, the students are required to do some experimental design work, after they have become familiar with the available instrumentation. We also have dedicated space for *Outreach and Physics Demonstrations* (GN 142), which can also be used for a *Capstone Project*, if needed.

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, or similar) 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.*

Room 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 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

Table 7.1. continued.

Room Number	Room Allocation	Occupant Name	Capacity	Size (sq. ft)	Primary Purpose
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	Mrs. Chavez	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

Table 7.1. *continued.*

Room Number	Room Allocation	Occupant Name	Capacity	Size (sq. ft)	Primary Purpose
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
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		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

Table 7.1. *continued.*

Room Number	Room Allocation	Occupant Name	Capacity	Size (sq. ft)	Primary Purpose
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* (GN 264), most which use a *Linux-operating system* but also several with a *Windows-operating system*. All workstations 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 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 *Department of Physics*. 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

Table 7.2. *- continued*

Lab	Type	Department	# of Computers
Gerald Thomas (Aggie Snack Bar/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 (PHYS315L, PHYS471, PHYS475 and PHYS493) do require special instructions to protect the student from possible injury. For example, some of the experiments in PHYS 315L and 493 utilize ionizing radiation, such as X-rays or radioactive sources. 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 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 are posted and can be reviewed at their website.

It should also be noted that three of the department's faculty members (Drs. Pate, Papavassiliou, Nakotte, Urquidi) are responsible for the use of radioactive sources in the building, and one of them (Dr. 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 for EP) and PHYS 476 (elective), to train students in the use of computers in addressing physics problems. Moreover, all EP students take computing courses in their chosen engineering concentration 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 $13M. 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 one exempt staff member, Mr. Francisco Carreto-Parra (MS in Physics), who is charged with maintaining and upgrading the instructional laboratories, and a graduate assistant, Mr. Seyedayat Ghazisaeed, (MS in Physics), who supports 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 – Institutional Support*). 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 would 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 & Sciences* to the central administration. Typical allocations to the *Department of Physics* used to be around $10k 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 currently 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 *NMSU's Board of Regents*. By state law, inventory items are defined as items with an acquisition cost of $1000 or higher, regardless of age or depreciation. *NMSU's Risk Management* includes property insurance with a $5000 deductible for any theft and a $1000 deductible for any loss due to 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 & Sciences*, 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 ($25k) 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 $8000 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*, but this practice has been discontinued due to difficult fiscal situation.

The *Department of Physics* has a *Laboratory Committee* that regularly 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 considered 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.

The two NMSU library facilities, *Branson Hall* and *Zuhl Library*, are major and essential resources of the university. The *University Library's* mission is to provide information to the faculty, students and citizens of New Mexico. The two libraries support the academic programs, as well as research and public service programs of the University.

Zuhl Library

The *Zuhl Library* opened in 1992 as the new library and got its name in 2000. The *Zuhl Library* provides services and resources in the arts, education, humanities, and social sciences. The library's main administration is based in *Zuhl Library*, as well as technical references, codes, and standards.

Branson Library

Branson Hall was the university's sole library facility prior to 1992. Branson provides services and resources in agriculture, business, government documents, science, and technology. The library's *Southwest and Border Studies* (archives, special collections), *Collection Services*, *Bibliographic Services*, *Access Services*, and *Systems* are also located in *Branson Hall*.

Both libraries are developed to foster academic success at every level. The *Zuhl Library* is open until 2 am, Sunday through Thursday; overall, the *NMSU Library* is open 111.5 hours during a normal academic week. The physical spaces offer a supportive learning and research environment that include:

- two library instruction labs
- 100 desktop computers available for student use
- technology lending, including laptops, iPads, and calculators
- 1 reference desk and a consultation room
- 7 group study rooms (3 rooms are equipped with collaborative learning technology)
- 8 PhD study carrels
- a presentation room

Additionally, students have 24/7 access to all electronic content, including e-journals, e-books, and databases.

The *NMSU Library* offers a program of hands-on instruction that promotes information literacy skills and critical thinking skills. Library instruction gives students the skills to locate, use, and evaluate information. These skills lead to increased academic success, better papers, and higher quality research projects while reducing library anxiety, and the incidence rate of plagiarism cases. NMSU faculty can schedule instruction sessions with librarians. The *NMSU Library* also offers credit courses including LIB 101 *Introduction to Research* (1 cr.) and LIB 311V *Information Literacy* (3 cr.).

Additional library instruction reference support takes the form of online research guides, or LibGuides. LibGuides provide students and faculty information and links to resources and services relevant to the discipline or course. The NMSU Library currently maintains 67 guides related to engineering topics, and those can be accesses through the library's webpages.

Collection categories of interest to students and faculty in the *College of Engineering* include: aerospace engineering, chemical engineering, civil engineering, electrical engineering, engineering physics, industrial engineering, mechanical engineering, and surveying engineering, and the library has more than 50,000 holdings in these or related areas. Specialized research assistance is available to engineering students and faculty. Researchers may seek face-to-face reference assistance from the library's *Reference Desk* in *Zuhl Library*, through-online chat or text message, email/mail, or by phone. The library's subject specialist for engineering maintains regular office hours and is available for individualized research consultations.

Engineering and science information are typically available through subscriptions to specialized databases. The NMSU Library currently offers access to the following databases:

- ENGnetBASE
- IEEE Xplore
- Synthesis Digital Library of Engineering & Computer Science

- ACM Portal (Association for Computing Machinery)
- ASTM Standards and Engineering Digital Library
- Techstreet Standards
- Energy & Power Source
- GeoRef
- GreenFILE
- MathSciNet
- Proquest Agricultural & Environmental Science (AGRICOLA & TOXLINE included)
- Water Resources Abstracts
- Web of Science
- Applied Science & Technology Source
- Emerald Insight
- Gale Virtual Research Library

Most of our access to both current and archival journal information is provided through databases with full text journal content. The titles listed in Table 7.3 are from the top quartile of *SCImago Journal Rank Indicator* are available through the *NMSU Library* holdings *via* print and/or electronic access.

<u>Note:</u> *SCImago Journal Rank Indicator* is "a measure of a journal's impact, influence or prestige. It expresses the average number of weighted citations received in the selected year by the documents published in the journal in the three previous years."

Table 7.3: *SCImago ranking of highly ranked engineering/science journals available at the NMSU Library through online access.*

Journal Title	SCImago Journal Rank
Nature Biotechnology	20.253
Nature Nanotechnology	18.746
Nature Materials	18.032
Nature Materials	8.364
Nano Letters	7.983
AC Nano	6.916
Archive for Rational Mechanics and Analysis	4.694
Materials Horizons	4.683
Journal for Operations Management	4.599
Automatica	4.172
ACS Photonics	3.516
Production and Operations Management	3.163
International Journal of Robotics Research	3.154
Journal of Product Innovation Management	3.086

The *NMSU Library* also offers and *Information Delivery Services* (IDS) provides online and mobile access to needed research information, whether owned by the university, another NMSU campus, or another library/organization. It provides global access to other research libraries. Specific services include *Interlibrary Loan*, *Document Delivery*, and courier services to and from faculty and doctoral candidates' offices. IDS also provide electronic or home delivery of materials to distance education students and faculty. In addition, the library also offers RapidILL which offers desktop delivery in under twenty-four hours with response time being as little as three hours. In 2017, the *NMSU Library* had a total of 8,950 RapidILL borrowing requests, and 8,796 (I.e., 98%) were met within an average time of 11.5 hours.

The *NMSU Library* system is one of three libraries which form the *U.S. Federal Shared Depository f*or the State of *New Mexico*. The *Government Documents Unit* of the *NMSU Library's Reference and Research Services* provide research support and access to governmental databases, such as the *Homeland Security Digital Library*, the *Technical Reports Archive and Image Library*, and the *Bielefeld Academic Search Engine*. The library also supports the *U.S. Patent and Trademark Resource Center* (PTRC), which offers access to patent and trademark information for *New Mexico* and other PTRCs in the United State. The library provides access to the examiner-based search engines and patent databases, PubEAST and PubWEST.

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 was greatly improved. Any future infrastructure work in the building will be done by the *University Plant Services*, to make sure that 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 result, we can 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 sent to the *Department Head*. They must be corrected within 30 days. The X-ray laboratory has an 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 and/or materials.

On many occasions (especially in the *Senior Student Exit Interviews*), our EP students indicated that available 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* (BSEP) is offered jointly by the *Department of Physics* in the *College of Arts & Sciences* and the *Departments of Chemical & Materials Engineering*, *Electrical & Computer Engineering*, and *Mechanical & 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 EP degree has been approved by the *NMSU Board of Regents* and is supported by the central administration, which promotes interdisciplinary programs and faculty engagement across departmental and college boundaries. Both colleges support the program and provide leadership and advice 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 BSEP program is shared between the *Physics Department Head* (Dr. Stefan Zollner), the *EP Program Committed Chair* (Dr. Heinz Nakotte), and the *Engineering Physics Program Committee*. Its current members are Drs. Heinz Nakotte, Tom Hearn, Steve Pate, Michael DeAntonio, Igor Vasiliev, all from *Physics*; Dr. Fangjun Shu from *Mechanical & Aerospace Engineering*; Dr. Steve Stochaj from *Electrical & Computer Engineering*; and Dr. Hongmei Luo from *Chemical & Materials Engineering*. The *Physics Department Head*, Dr. Zollner, will be on sabbatical leave during the 2018/19 academic year, and the *Dean of Arts & Sciences* has appointed Dr. Nakotte as the *Interim Department Head* for that period.

The *Physics Department Head* attends department head meetings (or similar events) in the *College of Arts & Sciences* and in the *College of Engineering*. On occasion, the *EP Program Committee Head* may attend the *College of Engineering* meetings on his behalf. When the *Physics Department Head* is absent from campus, he appoints an *Acting Department Head*. 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 & Sciences*, with the concurrence of *NMSU's Executive Vice President & Provost*. The *Physics Department Head* is evaluated annually by the *Dean of the College of Arts & Sciences*, with a more detailed 360-degree review done every three to five years. Items most relevant to the leadership of the *EP Program* are described below.

The 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 & Sciences*;
- assisting with the assessment of the EP undergraduate program in the *College of Engineering*;
- 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 the *NMSU Policies & Procedures*.

The *Physics Department Head* or an appointed representative also performs all exit interviews with EP students and reports his findings to the *EP Program Committee*. Furthermore, he seeks contact with program alumni.

The responsibilities of the *EP Program Committee Chair* include the following:

- assessment and accreditation of the *EP Program*;
- coordination of EP student advising;
- leadership for the *EP Program Committee*,
- representing the *Physics Department Head* at *College of Engineering* events, when needed;
- recruiting and retention of EP students;
- participation in *Aggie Welcome Orientations* (AWO) for new incoming students in the *College of Engineering.*

The *EP Program Committee* is appointed by the *Physics Department Head*, in consultation with the *EP Program Committee Chair*, the department heads of the participating engineering departments, and the *Associate Dean for Academics* in the *College of Engineering*. The *EP Program Committee* is chaired by the *EP Program Committee Chair*, and the *Physics Department Head* and the *Associate Dean for Academics* in the *College of Engineering* are *ex officio* members. The *EP Program 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.

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. Pate), the *Computer Committee* (chaired by Dr. Engelhardt), and the *Laboratory Committee* (chaired by Dr. Pate). All departmental committees regularly report back to the *Department Head* and the entire physics faculty at departmental faculty meetings, which are held at least once a month. Additional faculty meetings may be held for important topics, when needed, for example:

- to review the *Department's Promotion & 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 develop a long-term strategy of the department for future directions, 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 departmental retreat is held to allow more in-depth discussion. For example, there were discussions at the Spring 2018 retreat about whether the department should seek a separate ABET accreditation through its ANSAC commission for its *BS in Physics* degree program.

The *EP Program Committee* has established processes for soliciting feedback, collecting data, and communicating findings related to the *EP Program*. All relevant information and findings are documented and records are kept electronically in a single dedicated OneDrive folder, accessible for review by the *Department Head* or other physics faculty members at any time. The content of the OneDrive folder is continuously updated; for example, *Post-Course Instruction Materials* for all relevant courses are uploaded at the end of each semester. With that, the folder contains the *Outcomes Measurements* for every single course, and every faculty member is assigned to provide an *Outcomes Summary* for one outcome every 2-3 years - making use of the information provided in the *OneDrive* folder. These *Outcomes Summaries* are discussed in a special faculty meeting and the findings are used as input for program improvement. This process also provides important feedback for required *Annual Departmental Reviews* due with the *Deans of College of Arts & Sciences*. In addition, some of the non-sensitive information may be made publicly accessible *via* the program's webpages.

Important strategic decisions are made collegially by the physics faculty and reported to the *College of Arts & 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 Chairs*.

The *Physics Department Head* and the faculty of the *Department of Physics* embrace shared governance, wherever possible. To promote the shared-governance approach, the physics faculty have an opportunity to meet without the *Department Head* (for example, just prior to the retreat) 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*, which ones by faculty committees, and/or which ones by the entire faculty. The faculty will provide feedback on decisions made over the past year and guidance for the following year. At that meeting, the faculty members can also review which departmental committees are needed and what duties they should fulfill. Moreover, the entire faculty can propose which of its members should serve on various departmental, college, and university committees.

Since EP is highly interdisciplinary, our leadership model ensures that members of all relevant disciplines contribute to the leadership of the program, but there is also a clear chain of command: issues related to courses fall under the responsibility of the *Department Heads* and the *Academic Dean* of academic unit to which the course belongs, and issues related to EP students and degrees are dealt with by the *Physics Department Head* and the *Office of the Dean of Engineering*. The *EP*

Program Committee Chair acts in place of 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 & 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 about 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 *Executive Vice President and Provost* for consideration. The *Executive Vice President and Provost* may reallocate instructional funding among the Colleges or allocate any new funding in consultation with the *Deans*, *Chancellor*, and/or *Administration and Finance*.

Departmental Budget

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 5 different degree programs (3 undergraduate degrees, 2 graduate degrees), i.e. a *BS in Physics*, a *BA in Physics*, a *BS in EP*, a *MS in Physics* and a *Ph.D. in Physics*. The *BS in EP* requires a concentration to be selected from 4 options (*Aerospace*, *Chemical*, *Electrical* and *Mechanical Engineering* concentrations), the *BS in Physics* provides an option of 5 different concentrations (*Applied Optics*, *Applied Physics*, *Computational Physics*, *Geophysics* and *Materials Science*), the *BA in Physics* requires a minor in another field, and *MS in Physics* provides an option for a concentration in *Space Physics*. Expenditures towards these different degree programs and their concentrations 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 for the past decade, indicating strong continuous institutional support. 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). There was no significant decrease in our operational funds since 2011/12. Staff salaries are lower in the 2017/18 budget, because one administrative staff position remained vacant to reduce expenses. The vacancy was filled in spring 2018 with the hiring of Marisela Chavez as the administrative assistant.

Students in the *EP Program* take the same core courses in physics and in the engineering discipline of their chosen concentration that are offered to the majors in each discipline, i.e. no additional instructional expenses are needed to offer the *EP program*. Since the NMSU *Department of Physics* is comparatively small with a total of only 35-50 physics majors (the numbers fluctuate greatly from one year to another), the upper-division physics courses tend to have low enrollment, and offering an *EP program* ensures that those courses have sufficient enrollment (10 or more students are usually needed to offer an undergraduate course). In other words, the two programs (BS/BA Physics and BS EP) would not be viable as separate programs at NMSU, and therefore both undergraduate degree programs are housed in the same department. One obvious benefit of EP students taking the physics core courses together with the physics majors and the engineering core courses with the engineering majors of their chosen concentration is that this better prepares them for advanced (graduate) studies in both physics and engineering, if they desire to pursue them. Moreover, some of our EP students have indicated a stronger affinity with physics than with engineering, while others preferred the engineering portion.

Although the *Department of Physics* does not incur additional instruction costs by offering the *EP Program,* undoubtedly there is an increased administrative burden by offering this additional program. Much of that burden is currently covered by faculty members serving on the *EP Program Committee*, which has members from physics and engineering, as part of their allocated service load (see Criterion 6 – Faculty). On occasion, there may be smaller budget items specifically related to the *EP Program* (for example, costs related to the accreditation) and those are covered by the *Department of Physics* and/or the *College of Engineering*.

<u>Recurring budget items in the *Department of Physics*:</u>

- The *Instructional & General* (I&G) budget, which consists of *State of New Mexico* funds, is at \$1.70M in the 2017/18 fiscal year (up from \$1.59M in the 2011/12 fiscal year). The items in this budget contain the salaries of the *Physics Department Head* and staff (\$213k, down from \$229k in 2011/12 because of a vacant staff line), the faculty salaries (\$1087k, up from \$985k due to pay raises), the graduate teaching assistant salary pools (\$337k, up from $262k because of a benefits accounting change), and departmental operational funds ($65k, down from $80k in 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 $1.7M, about $140k 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 & Sciences*.
- A portion of the *Facilities and Administration* (F&A) costs charged to external research grants by the university is returned to the departments. After subtracting the departmental portion of startup commitments and cost share, the department received about $12k in 2016/17. This amount is unusually low because five recent tenure-track faculty hires lead to large F&A subtractions in the department's 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 $90k per year in earnings from *NMSU Foundation* endowed accounts (totaling about $2.5M). These funds are used to pay undergraduate student scholarships (scholarships of $500 to $3000 for about 20-30 students, totaling $55k), 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, a named professorship (*Gardiner Professorship*), and summer research support for graduate students. A very generous alumnus (a former 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 are currently no significant 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*, where he can advocate for scholarships to be awarded to EP students.

The *Department of Physics* I&G budget is established annually by the institution through the *College of Arts & Sciences*. The total I&G funds in the *Department of Physics* have grown by about 7% since 2011/12, see Table 8.1 for details. The institution has continued to support the *Department of Physics* since the 2012 ABET accreditation, for example, by renovating *Gardiner Hall* (which houses the *Department of Physics* and the *Geological Sciences Department*), replacing the *Administrative Assistant*, providing funds to regularize two *College Professors* for teaching, promoting faculty to the next rank, supporting sabbaticals, and by approving a five junior tenure-track faculty hires. Our undergraduate programs in physics and EP compare favorably in quality, enrollment, and graduation rates with similar institutions in the Rio Grande Valley, such as

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, such as *Texas Tech University, Texas A&M Kingsville, Angelo State University, West Texas A&M University, Abilene Christian University,* and *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	~15,000
Endowments	~60,000	~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 & Sciences Research Center* for departmental commitments (for example, for faculty start-up or mandatory cost-shares). The share returned to the *Department of Physics* was reduced from 24.5% to 16% in the 2004/05 fiscal year. Earnings from *NMSU Foundation* accounts are based on the $1.5M principal and can vary with the annual return on investments.

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 & Sciences* and the *College of Engineering.*

- 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 & Sciences*. In the 2017/18 fiscal year, the *Department of Physics* returned $91k to the *College of Arts & Sciences* as salary savings and received $82k 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*. Typical allocations to the *Department of Physics* have been around $15k in recent years.

Recurring and one-time funds in the *College of Engineering* are sometimes used to pay the salaries of instructors to teach the engineering courses and to provide support for the facilities and supplies for these courses. So far, the *College of Engineering* and its departments have had the primary responsibility to develop, teach and support the mandatory *Capstone Design Courses*, and almost all EP alumni took their capstone experience in an engineering discipline. The introduction of an engineering-wide capstone program in Fall of 2018 may offer an opportunity for physics faculty to become more involved in future capstone design courses. The *College of Engineering* also currently supports two *EP Ambassadors* (Pablo Paradis and Scott Mason Walls) as part of their *Engineering Student Ambassador Program*. The *EP Ambassadors* represent the *EP Program* to the public and they are involved in a variety of recruitment and outreach activities. The college also supports some other recruitment/retention activities for the *EP Program* as well as some student travel, undergraduate research and other awards.

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

NMSU 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 provides professional development to NMSU educators. While a variety of programming is provided, the recurring programs include:

- <u>teaching:</u> evidence-based instructional practices, team-based learning, peer coaching, and classroom observations
- <u>leadership:</u> advancing leaders, department head academy, crucial conversation, and strengths finder training
- <u>mentoring:</u> team mentoring for faculty, one-on-one faculty mentoring, getting the edge in academia
- <u>scholarship:</u> publish and flourish, writing groups, scholarly writing retreat
- <u>career:</u> promotion and tenure programs, new faculty orientation

NMSU's Instructional Innovation and Quality provides support to faculty in delivering education via the non-traditional formats of ITV, blended, and online. This group provides faculty with professional development and training for best practices in online learning and course consultations, ensures quality in blended and online course design, and provides 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 $337k, which equates to 17.3 half-time equivalent *Graduate Teaching Assistants* (TAs) in the 2017/18 fiscal year (fall and spring). Additional funds for teaching assistants are hired from *Facilities & Administrative Rates* (F&A) return or one-time funds from the *Provost*, *the Dean of Arts & Sciences*, or the *Dean of the Graduate School* - which brings the total number of TAs 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, while a smaller fraction of TAs is employed as graders and/or tutors. Each semester, the *Department of Physics* teaches laboratory sections for about 650 students. TAs also work in the physics tutoring center for about 2-3 hours per week to assist students with their general-education physics homework. International students assigned as lab TAs are required to have passed the *International Teaching Assistant* (ITA) screening administered by *the Office of the Associate Provost of International and Border Programs*. Lab TAs are trained by the *Department of Physics* in an orientation session at the beginning of the semester. The responsibility for hosting the orientation session and the distribution of TA assignments rests with the *Graduate Physics Program Chair*, Dr. Vassili Papavassiliou. Day-to-day supervision for the lab TAs is provided by the *Physics Lab Coordinator*, Mr. Francisco Carreto-Parra, and by a faculty instructor-of-record. TAs who are assigned as homework graders have 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 will typically use an online homework software package, such as *Mastering Physics*, in their large lower-division physics courses.

The *Department of Physics* also hires undergraduate physics and EP students as *Peer Learning Assistants* (PLAs). They may provide additional help in the tutoring room, assist with supplemental instruction in the lower-division courses and/or assist with setting up experiments in the introductory 200-level or 300-level modern physics laboratories, under the supervision of Mr. Carreto-Parra or Dr. Pate.

In the summer session, the introductory physics courses, PHYS 211G, 212G, and 215G are usually taught by experienced TAs as lecturers (typically, PhD students with a MS degree and previous TA experience). One of the more demanding (and larger enrollment) summer courses, PHYS 216G, has recently been taught by a faculty member (Drs. DeAntonio or Nakotte). Depending on the number of lab sections needed, another 4-6 graduate students are hired to support the associated labs for the courses above.

NMSU offers several on-campus programs to promote good teaching and enhance of instructional skills, 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. Many of our physics faculty participate in *Teaching Academy* events each year. The *College of Arts & Sciences* and the *College of Engineering* encourage their faculty to participate in relevant *Teaching Academy* events. In addition, once or twice a year, the *Department of Physics* also invites an established *Physics Education Researcher* (PER) as a colloquium speaker to inform the faculty 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:

- With Francisco Carreto-Parra (MS in Physics from UTEP), a new permanent *Instructional Lab Manager* was hired. A lab manager with a graduate degree can better relate to the TAs in the department. Mr. Carreto-Parra has excellent experimental and practical skills.
- Quite commonly, a first-year TA will be paired with an experienced TA in one lab, thereby allowing the new TA to learn faster by observation.
- The responsibility for the lower-division instructional labs was moved from lab manager to a faculty member as instructor-of-record. The instructor-of-record faculty member will preferably teach one lab section himself/herself, thereby getting first-hand experience where improvements or modifications in the various labs are needed. Another task for the instructor-of-record faculty member is to make improvements to laboratory experiments when needed, or to develop new instructional laboratories. For example, in the past year or so, new labs on projectile motion and oscilloscope operation were added. Finally, the instructor-of-record faculty member will chair the weekly TA meetings to prepare for the scheduled labs during the following week.
- In the past two years, the *Physics Department Head* taught the first-year labs for physics and EP majors with the help of a TA, which allowed for more one-on-one mentoring of the new students in a semi-formal environment.
- To address a few severe cases of cheating, all TAs were trained on how to identify and 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, for many years, NMSU has had 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* (UBC), 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 UBC and subsequently approved by the *Chancellor*. Additionally, available equipment funds are provided annually to colleges and departments based upon an allocation calculation accounting for existing equipment inventory. 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 the past few years, BRR and ERR funds were extremely limited (largely due to relatively flat or reduced contributions from the *State of New Mexico* to higher education and increased utility/maintenance costs), and the *Department of Physics* and the *EP Programs* did not receive any such allocations or funds from the other sources mentioned in the preceding paragraph. The department managed to cover the most critical and pressing needs through departmental operations funds, earnings from *Foundation* endowments, or from student fees - especially the *Engineering Technology Fee* charged to all *College of Engineering* students.

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* (PER). 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. NMSU faculty, staff and student ID cards are equipped with a magnetic strip, which provides access to the building and rooms, for which access was granted.

EP students have access to the building during evening and weekend hours using their student ID 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, or similar) are paid from the departmental operations budget, except for technology improvements in centrally scheduled classrooms (GN 229, 230, 218A), which are paid centrally by NMSU's campus-wide *Information & Communications Technology* (ICT) support.

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 adequate to meet the needs of the stated *Program Outcomes* and *Educational Objectives* of the *EP Program*. We have many outstanding world-class physicists and engineers as instructors (see *Appendix B – Faculty Vitae*), who are also passionate about undergraduate instruction. Many of the physics faculty are involved in forefront research projects, and they occasionally include their experiences into upper-level physics courses or offer undergraduate research opportunities related to the projects. For example, Dr. Boris Kiefer has gotten involved in a research project in 3D printing, and one of our current EP students is helping with the mechanical testing the printed specimens. An estimated 1 in 3 of our undergraduate students have participated in research or experiential learning activities (experimental or computational) with NMSU faculty or at NSF-funded *Research Experience for Undergraduates* (REU) sites at other institutions, thereby promoting the *Program Outcomes* related to experimental training, design abilities, communication skills, and/or technical know-how.

All physics courses required for the *EP Program* are scheduled at least once per year and are generally taught by a faculty member with a *Ph.D. in Physics*. Occasionally, the *College of Arts & 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. Students are advised as early as possible to find room in required calculus courses during the pre-registration period. Therefore, EP students can graduate in 8 semesters, provided they are ready for MATH 191 (Calculus I) in their first semester at NMSU.

The departmental operating and equipment budgets and resources are sufficient to provide adequate instructional laboratory and computational facilities for our students. Capstone and upper-division laboratory courses are sometimes linked to a faculty's research project, 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 the *Senior Student Exit Interviews*, students generally express an overall satisfaction with our institutional resources that are dedicated to the *EP Program*.

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.

As of spring 2018, the *Department of Physics* currently has 10 full-time tenured faculty members, including the *Physics Department Head*, and 4 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. The typical teaching load for a tenured or tenure-track faculty in the *Department of Physics* is 3 courses per year (spring and fall), However, some faculty members have reduced teaching loads due to research course buy-outs or bridged positions with national labs, sabbaticals or other types of 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. Research buy-outs, sabbaticals and similar will provide salary savings that are used to hire temporary instructors to cover a faculty member's teaching allocation. There are also 2 half-time college-track (teaching) faculty members. When combined, in principle, these 14.5 FTE faculty instructors would be just about enough to provide adequate teaching, advising, and assessment support for all physics programs, including EP. However, the *Department of Physics* lost some faculty lines (due to retirement or similar) in recent years, and current research buyouts and/or bridged faculty positions further reduce the number of full-time faculty available for teaching. Subsequently, some lower-division introductory-physics courses or instructional laboratories are sometimes taught by experienced TAs with an *MS in Physics*. Required courses are offered at least once per year, thus allowing students to graduate in four years, provided they are ready for MATH 191 (Calculus I) in their first semester.

The *Department of Physics* also has three full-time staff members on campus. Rosa Christensen is the (non-exempt) *Administrative & Fiscal Assistant* and Marisela Chavez has been recently hired as the second (non-exempt) *Administrative Assistant*. The two administrative assistants share responsibilities that 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. Rosa Christensen also supervises spending of departmental I&G funds. The third full-time staff member is Francisco Carreto-Parra, who is the (exempt) instructional lab manager.

Research faculty and staff members hired entirely for research through external grants and contracts are not discussed here, since their interaction with the *EP Program* has been minimal over the past five years. However, such research staff might provide opportunities for future engineering-wide *Capstone Design Projects* that involve EP students.

Training for the non-exempt staff members (*Administrative Assistants* and *Fiscal Monitor*) on NMSU business procedures (hiring procedures, record retention, general employee safety, and similar) is made available by the institution. As part of professional development, the (previous and current) instructional lab managers were encouraged to attend 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 listen to 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.

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. The department's request for a new faculty lines includes a request for start-up funds, determined by the nature of the position and budgetary considerations. 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 $65k, 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 & Sciences*, the *Department of Physics* submits a position request form to the *Office of the Provost* through the *College of Arts & Sciences*. The position request will also include the proposed job ad and a description of the position. The *Physics Department Head* appoints the *Chair of the Search Committee* and both meet with the *Vice President for Research* and the *Associate Dean for Research* in the *College of Arts & Sciences* to sign a firm commitment for start-up for the new faculty member. (For the most recent hire starting in January 2018, an agreement was reached for a start-up package of $190). 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 & 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. For faculty searches in the areas of *Applied Optics*, *Applied Physics* or *Materials Sciences*, the external member on the *Search Committee* is typically selected from *College of Engineering* departments participating in the *EP Program*.

The advertisement for the position, approved by *Human Resources*, is distributed as a print ad in publications of relevant professional societies (for example, *Physics Today*) and as an online ad 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 4-5 candidates for interview. This short list is presented to the physics faculty, the *Dean of the College of Arts & Sciences*, and the *Office of Institutional Equity* for approval. During the on-campus interview, each candidate will meet with the *Dean* (or an *Associate Dean*), the *Vice President for Research*, and all the physics faculty available during the visit, present a research colloquium to the whole department, teach a lower-division physics lecture assigned prior to the visit, and present a "pizza seminar" to a group of graduate students. The *Chair of the Search Committee* collects feedback about each candidate. Students can make written comments using an anonymous feedback form, while faculty members provide feedback with their name attached. After the conclusion of all on-campus 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 students. The 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 of the College of Arts & Sciences* expressing the conclusions of the *Department of Physics* 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 to.

Describe strategies used to retain current qualified faculty.

The Department Head and the College Administration strive to sustain an engaging and rewarding professional work environment, such 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 & 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 & 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 (such as the *Distinguished Achievement Professorship* awarded to Dr. Matthias Burkardt). Dr. Jim Ni (emeritus physics faculty) and Dr. Stefan Zollner were recognized by the *NMSU Vice President and 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 *Department of Physics* has not had one since 2009.

If a physics faculty member with a strong record of performance receives an offer from another institution, NMSU will make efforts 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, a retention commitment for student support, summer salary, financial support (for travel, equipment, supplies or similar), or accommodation of a spouse or partner. The financial burden for such retention incentives is borne entirely by the *College of Arts & 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 & Sciences* and the *Department of Physics*.

Effective July 1, 2018, there will be an average 2% pay increase for faculty and staff. The pay increase for faculty in the departments of the *College of Arts & Sciences* are solely based on performance over the past two years for annual salaries exceeding \$50k. Using the *Digital Measures* system, each faculty member is required to submit an *Annual Performance Report* (APR), which are due with the *College of Arts & Sciences* around mid-November (faculty not up for promotion) or October (faculty up for tenure and/or promotion). Faculty will submit their APRs to the *Department of Physics* typically about a month prior to the college's deadlines. To evaluate faculty performance, two tenured faculty members are selected at the first faculty meeting in the fall semester. These faculty members are 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 & Sciences*, will be considered in determining raises and other reward system elements.

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*. It is stated that *"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 & 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*, *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 (typically, more than $100k 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), many conferences (such as the M*arch Meeting of the American Physical Society*) 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 & 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*, ASEE, or the *American Association of Physics Teachers*, AAPT). 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 in meetings with individual faculty or with groups of faculty members.

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 *Engineering Physics (EP) Program* at *New Mexico State University* does not have any program-specific criteria.

Appendix A: Syllabi

Engineering Physics

Bachelor of Science in Engineering Physics

Self-Study Report

New Mexico State University

Engineering Physics Program

(Bachelor of Science in Engineering Physics)

at

New Mexico State University

Syllabi of Physics Courses

Course Number and Name: Physics 213, Mechanics

Credits and Contact Hours: 3 credits (two 75-minute classes each week); an additional 2 contact hours each week (during office hours); optional 1 credit supplemental instruction.

Instructor or Course Coordinator Name: Michael Engelhardt

Textbook: H. D. Young, R. A. Freedman and A. L. Ford, *University Physics with Modern Physics*, Pearson, 14th edition, 2016

a) other supplemental materials: MasteringPhysics for Young and Freedman, 14th edition.

Specific Course Information:

a) **catalog description:** Newtonian mechanics

b) **prerequisites or co-requisites:** MATH 191G

c) This course, or its alternative PHYS 215G, *Engineering Physics I,* is required for majors in Physics and Engineering Physics

Specific Goals of the Course:

a) **specific outcomes of instruction:** This course sets the foundation for the undergraduate physics and engineering physics curricula. It provides the fundamental ideas underlying classical mechanics, the application of these ideas to quantitative physics problems, and the relationship between models physicists use and real-world phenomena.

b) related ABET Outcomes: PHYS 213 addresses Program Outcome a) Scientific Expertise: *an ability to apply knowledge of mathematics, science, and engineering.*

Brief List of Topics Covered:

The course covers material from Chapters 1-11, 13-15 of Young and Freedman's textbook.

1. Chapter 1: Units, Physical Quantities, and Vectors, Sec. 1-10
2. Chapter 2: Motion Along a Straight Line, Sec. 1-5
3. Chapter 3: Motion in Two or Three Dimensions, Sec. 1-4
4. Chapter 4: Newton's Laws of Motion, Sec. 1-6
5. Chapter 5: Applying Newton's Laws, Sec. 1-5
6. Chapter 6: Work and Kinetic Energy, Sec. 1-4
7. Chapter 7: Potential Energy and Energy Conservation, Sec. 1-5
8. Chapter 8: Momentum, Impulse, and Collisions, Sec. 1-5
9. Chapter 9: Rotation of Rigid Bodies, Sec. 1-5
10. Chapter 10: Dynamics of Rotational Motion, Sec. 1-6
11. Chapter 11: Equilibrium and Elasticity, Sec. 1-3
12. Chapter 13: Gravitation, Sec. 1-5
13. Chapter 14: Periodic Motion, Sec. 1-5
14. Chapter 15: Mechanical Waves, Sec. 1-5

Prepared by Michael Engelhardt, Fall 2017.

Course Number and Name: Physics 213L, Experimental Mechanics, Fall 2017

Credits and Contact Hours: 1 credit (one 2-1/2 hour lab per week).

Instructor's or Course Coordinator's Name: Stefan Zollner

Textbook: The lab materials were developed by Dr. Steve Kanim (emeritus) of the NMSU Department of Physics. They are distributed on the course learning management system (Canvas). Lab 1 is printed out for the students; students are responsible for printing out other lab and homework materials. We also use RAT/CAT forms to test the students' knowledge before and after the lab completion.

Specific Course Information:

a) **catalog description:** Laboratory experiments associated with the material presented in PHYS 213.

b) **prerequisites or co-requisites:** PHYS 213 *(pre- or co-requisite)*.

c) This course is the companion laboratory to Physics 213, Mechanics and is required by all physics and engineering physics majors. EP majors can also take PHYS 215GL instead.

Specific Goals of the Course:

a) **specific outcomes of instruction:** Students in this course perform a series of experiments that apply the principles and concepts highlighting the main objectives covered in the coursework for PHYS 213.

b) related ABET Outcomes: PHYS 213L addresses program outcome *b) an ability to design and conduct experiments.*

Brief List of Topics Covered:

Experiments are performed, data collected and analyzed encompassing: kinematics, dynamics, energy, work, momentum, and their conservation concepts and rotational motion and extended body problems. Below is the list of labs covered over the course of the semester:

1. Buoyancy
2. Description of motion in one dimension
3. Acceleration in one dimension
4. Projectile motion in two dimensions
5. Description of motion in two dimensions
6. Forces
7. Addition of forces
8. Newton's second law
9. Change in energy
10. Conservation of momentum
11. Rotational motion
12. Torque
13. Simple harmonic motion
14. Standing waves

Prepared by Stefan Zollner, Fall 2017.

- **Course Number and Name:** Physics 214, Electricity and Magnetism

- **Credits and Contact Hours:** 3 credits (three 50-minute classes each week); an additional 2 contact hours each week (during office hours); optional 1 credit supplemental instruction

- **Instructor's or Course Coordinators Name:** Michaela Burkardt

Textbook: D. Young and R. A. Freedman, *University Physics with Modern Physics*, 14th edition, Pearson Addison-Wesley, 2016

a) other supplemental materials: Mastering Physics for Young and Freedman, 14th edition, numerous handouts distributed as paper copies or via Canvas course management system

- **Specific Course Information:**
- **a) catalog description:** Charges and matter; electric field; Gauss law; electric potential; magnetic field, Amperes law; Faradays law; electric circuits; AC currents, Maxwell's equations; electromagnetic waves
- **b) prerequisites:** PHYS 213 or PHYS 215G
  prerequisites or co-requisites: MATH 192G
- **c)** This course is required for majors in Physics and Engineering Physics as well as Chemistry; (alternative: PHYS216G, *Engineering Physics II*)

- **Specific Goals of the Course:**

a) specific outcomes of instruction: This course teaches the fundamental ideas underlying electricity and magnetism, the interplay between these ideas of physics and mathematics, and the application of these ideas to quantitative physics problems and real-world phenomena.

b) related ABET Outcomes: PHYS 214 addresses the following Program Outcome:

a) *Apply knowledge of math, science and engineering.*

- **Brief List of Topics Covered:**
- *The course covers material from Chapters 21-32 of Young and Freedman's textbook. Number of lectures spend on each section are indicated.*

1. Chapter 21: Electric Charge and Electric Field, Sec. 1-7: (7 lectures)
2. Chapter 22: Gauss's Law, Sec. 1-5: (2 lectures)
3. Chapter 23: Electric Potential, Sec. 1-5: (3 lectures)
4. Chapter 24: Capacitance and Dielectrics, Sec. 1-6: (3 lectures)
5. Chapter 25: Current, Resistance and Electromotive Force, Sec. 1-6: (2 lectures)
6. Chapter 26: Direct-Current Circuits, Sec. 1-5: (3 lectures)
7. Chapter 27: Magnetic Field and Magnetic Forces, Sec. 1-9: (4 lectures)
8. Chapter 28: Sources of Magnetic Fields, Sec. 1-8: (3 lectures)
9. Chapter 29: Electromagnetic Induction, Sec. 1-8: (4 lectures)
10. Chapter 30: Inductance, Sec. 1-6: (2 lectures)
11. Chapter 31: Alternating Current, Sec. 1-6: (3 lectures)
12. Chapter 32: Electromagnetic Waves, Sec. 1-4: (2 lectures)
13. Review (2 lectures)

- 3 Midterm Exams, 1 Comprehensive Final Exam

- ***Prepared by Michaela Burkardt, Spring 2017.***

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Course Number and Name: Physics 214L, Electricity and Magnetism Laboratory, Spring 2018

Credits and Contact Hours: 1 credit (one 2-1/2 hour lab per week).

Instructor's or Course Coordinator's Name: Stefan Zollner

Textbook: Tutorials in Introductory Physics and Homework Package, by McDermott and Shaffer, Addison-Wesley, 2002.

Specific Course Information:

a) **catalog description:** Laboratory experiments associated with the material presented in PHYS 214.

b) **prerequisites or co-requisites:** a C- or better in PHYS 213L or PHYS 215GL *(pre-requisites)* and PHYS 214 *(pre- or co-requisite)*.

c) This course is the companion laboratory to Physics 214, Electricity and Magnetism. It is required by all physics and engineering physics majors. Engineering Physics majors can satisfy the requirement by taking PHYS 216GL instead.

Specific Goals of the Course:

a) **specific outcomes of instruction:** Students in this course perform a series of experiments that apply the principles and concepts highlighting the main objectives covered in the coursework for PHYS 214.

b) related ABET Outcomes: PHYS 214L addresses program outcome *b) an ability to design and conduct experiments.*

Brief List of Topics Covered:

Experiments are performed, data collected and analyzed encompassing: electrostatics, electric circuits, magnetism, electromagnetism and light, including geometrical and physical optics. Below is the list of labs covered over the course of the semester:

1. Charge
2. Oscilloscope
3. Electric field and flux
4. Gauss's Law
5. Electric potential difference
6. Circuits I
7. Circuits II
8. Capacitance
9. RC circuits
10. Magnets and magnetic fields
11. Measurement of e/m
12. Magnetic interactions
13. Lenz's law
14. Faraday's law

Prepared by Stefan Zollner, Spring 2018.

Course Number and Name: Physics 215G, Engineering Physics I

Credits and Contact Hours: 3 credits (two 75-minute lectures each week); an additional contact hour each week (during office hours). Evening review sessions before exams. Tutoring room assistance and supplemental instruction also available (optional).

Instructor or Course Coordinator Name: Stephen Pate

Textbook: H.D. Young and R.A. Freedman, *University Physics*, 14th edition, Pearson, 2016

a) other supplemental materials: available at https://learn.nmsu.edu

Specific Course Information:

a) catalog description: Calculus-level treatment of kinematics, work and energy, particle dynamics, conservation principles, simple harmonic motion.

b) prerequisites or co-requisites: MATH 191G *(pre-requisite)*

c) This course (or the equivalent PHYS 213) is required for all majors in the College of Engineering (except Eng. Tech.), all Physics majors and some Chemistry majors.

Specific Goals of the Course:

a) specific outcomes of instruction: PHYS 215 introduces students to the discipline of problem-solving using the elementary principles of mechanics. We will study the motion of masses in 1, 2 and 3 dimensions, including the important case of rotation about a fixed axis. Students will learn to understand and manipulate the fundamental concepts of energy, linear momentum, and angular momentum.

b) related ABET Outcomes: This course supports ABET outcome a) *an ability to apply knowledge of mathematics, science, and engineering.*

Brief List of Topics Covered:

The course covers the following chapters in the Young & Freedman textbook. The number of lectures spent on each section are indicated.

1. Chapter 1, Sec. 1-10: Units, physical quantities and vectors (2 lectures)
2. Chapter 2, Sec. 2-5: Motion along a straight line (2 lectures)
3. Chapter 3, Sec. 1-4: Motion in two or three dimensions (2 lectures)
4. Chapter 4, Sec. 1-6: Newton's laws of motion (2 lectures)
5. Chapter 5, Sec. 1-5: Applying Newton's laws (3 lectures)
6. Chapter 6, Sec. 1-4: Work and kinetic energy (2 lectures)
7. Chapter 7, Sec. 1-5: Potential energy and energy conservation (3 lectures)
8. Chapter 8, Sec. 1-5: Momentum, impulse, and collisions (2 lectures)
9. Chapter 9, Sec. 1-5: Rotation of rigid bodies (2 lectures)
10. Chapter 10, Sec. 1-6: Dynamics of rotational motion (2 lectures)
11. Chapter 11, Sec. 1-3: Equilibrium and statics (1 lecture)
12. Chapter 13, Sec. 1-5: Gravitation (1 lecture)
13. Chapter 14, Sec. 1-5: Periodic motion (2 lectures)
14. Chapter 15, Sec. 1-4: Mechanical waves (1 lecture)

Prepared by Stephen Pate, Spring 2018.

- **Course Number and Name:** Physics 215GL, Engineering Physics I Laboratory
- **Credits and Contact Hours:** 1 credit (one 2-1/2 hour lab per week, up to 12 labs).
- **Instructor or Course Coordinators Name:** Thomas Hearn
- **Textbook:** The lab materials were developed by Dr. Steve Kanim of the NMSU Physics Department. They are distributed on the on the course website. Lab one is printed out for the students; students are responsible for printing out other lab and homework materials
- **Specific Course Information:**
- **a) catalog description:** Laboratory experiments associated with the material presented in PHYS 215G. Co-requisite: PHYS 215G. Students wishing to use the PHYS 215G-216G sequence to satisfy the basic natural science general education requirement must register for either PHYS 215GL or PHYS 216GL.
- **b) prerequisites or co-requisites:** PHYS 215 *(pre/co-requisite)*.
- **c)** This course is the companion laboratory to Physics 215, Engineering Physics I. It is required by all engineering majors, with the exception of Engineering Technology.
- **Specific Goals of the Course:**
- **a) specific outcomes of instruction:** Students in this course perform a series of experiments that apply the principles and concepts highlighting the main objectives covered in the coursework for PHYS 215.
- **b) related ABET Outcomes:** PHYS 215L addresses program outcome *b) an ability to design and conduct experiments.*
- **Brief List of Topics Covered:**
- *Experiments are performed, data collected and analyzed encompassing: kinematics, dynamics, energy, work, momentum, and their conservation concepts and rotational motion and extended body problems. Below is the list of labs covered over the course of the semester:*

1. Descriptions of motion
2. Acceleration in one dimension
3. Motion in two dimensions
4. Forces
5. Addition of forces
6. Newton's second law
7. Energy
8. Conservation of momentum
9. Rotational motion
10. Torque
11. Simple harmonic motion
12. Standing waves

- ***Prepared by Tom Hearn, Spring 2018.***

Course Number and Name: Physics 216G, Engineering Physics II

Credits and Contact Hours: 3 credits (three 50-minute lectures each week); an additional 2 contact hours each week (during office hours)

Instructor or Course Coordinator Name: Lauren Waszek

Textbook: Young and Freedman, University Physics with Modern Physics, 14th Ed.

a) other supplemental materials: *Mastering Physics* online homework for Young and Freedman, 14th edition.

Specific Course Information:

a) catalog description: A calculus-level treatment of topics in electricity, magnetism, and optics.

b) prerequisites or co-requisites: PHYS 213 or 215G, MATH 192G *(pre-reqs)*.

c) This course is required for most engineering disciplines, except Engineering Technology and Survey Engineering. It can also substitute PHYS214 for Engineering Physics majors.

Specific Goals of the Course:

a) specific outcomes of instruction: This course provides a calculus-based introduction to electricity, magnetism, basic electronic circuits, and basic optics. PHYS 215G and PHYS 216G prepare students for upper-division courses in engineering and physical sciences.

b) related ABET Outcomes: PHYS 216G addresses Program Outcome a - an ability to apply knowledge of mathematics, science, and engineering.

Brief List of Topics Covered:
The course covers all of the material from Chapters 21-35 of the textbook. Approximate numbers of lectures spent on each chapter are indicated.

1. Chapter 21: Electric Charge and Electric Field, 3
   Chapter 22: Gauss' Law, 3
2. Chapter 23: Electric Potential, 3
   Chapter 24: Capacitance and Dielectrics, 3
   Chapter 25: Current, Resistance, and Electromotive Force, 3
3. Chapter 26: Direct-Current Circuits, 3
4. Chapter 27: Magnetic Field and Magnetic Forces, 3
5. Chapter 28: Sources of Magnetic Field, 3
   Chapter 29: Electromagnetic Induction, 3
6. Chapter 30: Inductance, 1
7. Chapter 31: Alternating Current, 1
8. Chapter 32: Electromagnetic Waves, 2
9. Chapter 33: The Nature and Propagation of Light, 3
10. Chapter 34: Geometric Optics, 3
11. Chapter 35: Interference, 1
12. Examination review sessions: 4

Mid-terms: 2

Prepared by Lauren Waszek, Fall 2017.

Course Number and Name: Physics 216GL, Engineering Physics II Laboratory

Credits and Contact Hours: 1 credits (one 2-1/2 hour lab per week).

Instructor or Course Coordinator Name: Heinz Nakotte

Textbook: Tutorials in Introductory Physics and Homework Package, by McDermott and Shaffer, Addison-Wesley Publishers, 2002.

Specific Course Information:

a) catalog description: Laboratory experiments associated with the material presented in PHYS 216G.

b) prerequisites or co-requisites: PHYS 213L or 215GL *(pre-requisites)* and PHYS 216G *(co-requisite)*.

c) This course is the companion laboratory to PHYS 216G, Engineering Physics II. It is required by all engineering majors, with the exception of Engineering Technology. EP majors can satisfy this requirement by taking PHYS 214L instead.

Specific Goals of the Course:

a) specific outcomes of instruction: Students in this course perform a series of experiments that apply the principles and concepts highlighting the main objectives covered in the coursework for PHYS 216G.

b) related ABET Outcomes: PHYS 216GL addresses program outcome *b) an ability to design and conduct experiments.*

Brief List of Topics Covered:

Experiments are performed, encompassing: electrostatics, electric circuits, magnetism, electromagnetism and light, including geometrical and physical optics. Below is the list of labs offered over the course of the semester; students will typically perform 12 out of these 14 labs:

1. Charge
2. Electric field and flux
3. Gauss's Law
4. Electric potential difference
5. Circuits I
6. Circuits II
7. Magnets and fields
8. Magnetic interactions
9. Measurement of e/m
10. Lenz's law
11. Faraday's law
12. Plane and curved mirrors
13. Ray diagrams and convex lenses
14. Interference and Diffraction

Prepared by Heinz Nakotte, Fall 2017.

Course Number and Name: Physics 217: Heat, Light, and Sound

Credits and Contact Hours: 3 credits (three 50-minute lectures each week); an additional 2 contact hours each week (during office hours); optional 1 credit supplemental instruction.

Instructor or Course Coordinator Name: Michaela Burkardt

Textbook: D. Young and R. A. Freedman, *University Physics with Modern Physics*, 14th edition, Pearson Addison-Wesley, 2016

a) other supplemental materials: numerous handouts distributed as paper copies or via Canvas course management system

Specific Course Information:

a) catalog description: Calculus-level treatment or thermodynamics, geometrical and physical optics, and sound.

b) prerequisites or co-requisites: PHYS 213 or 215G *(pre-req)*

c) This course is required for all majors in Physics and Engineering Physics.

Specific Goals of the Course:

a) specific outcomes of instruction: Students should become familiar with the concepts of waves (on a string, sound, and light), wave propagation and interference, and the description of these phenomena. Fundamentals of ray optics are discussed with applications. The section on thermodynamics in the course discusses the laws or thermodynamics and their use to describe thermal processes in engineering applications.

b) related ABET Outcomes: PHYS 217 addresses the following Program Outcomes: *a) Apply knowledge of math, science, and engineering*

Brief List of Topics Covered:

The course covers material from Chapters 14 (review), 15-20, 32-36, 39 (in part) of the Young and Freedman textbook. The number of lectures spent on each section are indicated.

1. Chapter 14: Review Periodic Motion (2)
2. Chapter 15: Mechanical Waves (4)
3. Chapter 16: Sound and Hearing (6)
4. Chapter 32: Electromagnetic Waves, Sec.1, 3-5 (1)
5. Chapter 33: Nature and Propagation of Light (2)
6. Chapter 34: Geometric Optics (4)
7. Chapter 35: Interference (2)
8. Chapter 36: Diffraction (2)
9. Chapter 39: Particles Behaving as Waves (1) Sec. 2, 3, 5 (Quantization of Energy, Photons)
10. Chapter 17: Temperature and Heat (3)
11. Chapter 18: Thermal Properties of Matter (3)
12. Chapter 19: First Law of Thermodynamics (3)
13. Chapter 20: Second Law of Thermodynamics (4)
14. Review (3)

Prepared by Michaela Burkardt, Fall 2017.

Course Number and Name: Physics 217L: Experimental Heat, Light, and Sound

Credits and Contact Hours: 1 credit (one 150-minute lab each week); an additional 2 contact hours each week (during office hours)

Instructor or Course Coordinator Name: Michaela Burkardt

Textbook: The lab manuals were developed in the NMSU Department of Physics for this course. Descriptions were updated and new laboratories developed by Dr. Michaela Burkardt.

a) other supplemental materials: assignments files and (optional) multimedia resources distributed via Canvas course management system

Specific Course Information:

a) catalog description: Laboratory experiments associated with the material presented in PHYS 217.

b) prerequisites or co-requisites: PHYS 217 *(pre/co-requisite)*

c) This course is required for all majors in Physics and Engineering Physics.

Specific Goals of the Course:

a) specific outcomes of instruction: Students should become familiar with the experimental exploration of basic phenomena in nature, data analysis, and the preparation of laboratory reports.

b) related ABET Outcomes: PHYS 217L addresses the following Program Outcomes (*b) design and conduct experiments, as well as to analyze and interpret data, (c) an ability to design a system, component, or process to meet desired needs with realistic constraints, (d) an ability to function in multi-disciplinary teams,* and *(g) an ability to communicate effectively,*

Brief List of Topics Covered:

The students perform 14 experiments during the semester, and each student writes an individual assignment report for each experiment. All assignments require analysis and interpretation of data. In addition, each assignment focusses on components of writing lab reports.

1. Measuring and Uncertainty Analysis
2. Vibrations of a String
3. Properties of Sound
4. Resonance Modes in a Tube
5. Linear Polarization
6. Reflection and Mirrors
7. Refraction and Lenses
8. Interference
9. Bragg Reflection
10. Statistics
11. Thermal Expansion
12. Thermal Radiation
13. Ideal Gas Laws
14. Calorimetry

Prepared by Michaela Burkardt, Fall 2017.

Course Number and Name: Physics 303V, Energy and Society

Credits and Contact Hours: 3 credits (online asynchronous 150 minutes each week); an additional contact hour each week (during online office hours)

Instructor or Course Coordinator Name: Edwin Fohtung

Textbook: Roger A. Hinrichs, Merlin H. Kleinbach Energy: Its Use and the Environment

a) other supplemental materials: none

Specific Course Information:

a) catalog description: Traditional and alternative sources of energy. Contemporary areas of concern such as the state of depletion of fossil fuels; nuclear energy, solar energy, and other energy sources; environmental effects; nuclear weapons; and health effects of radiation. Discussion of physical principles and impact on society. Focus on scientific questions involved in making decisions in these areas. No physics background required.

b) prerequisites or co-requisites: None

c) This course is an elective in Engineering Physics for students with Electrical and Mechanical concentrations.

Specific Goals of the Course:

specific outcomes of instruction: In this course, we will discuss topics as diverse as Home Energy Conservation, Solar Energy, Energy from Fossil Fuels, Air Pollution and Energy Use, Global Warming and Thermal Pollution, Electricity from Solar, Wind, and Hydro, Nuclear Power: Fission and Fusion, Biomass: From Plants to Garbage, and Geothermal Energy.

related ABET Outcomes: f) an understanding of professional and ethical responsibility; h) the broad education necessary to understand impact of engineering solutions in global, economic, environmental and societal context; i) a recognition of the need for, and the ability to engage in lifelong learning; j) a knowledge of contemporary issues.

Brief List of Topics Covered:

The course covers material from Chapters 1-19 Roger A. Hinrichs' and Merlin H. Kleinbach's book.

1. General Introduction
2. Energy Mechanics.
3. Conservation of Energy.
4. Heat and Work.
5. Home Energy Conservation and Heat-Transfer Control.
6. Solar Energy: Characteristics and Heating.
7. Energy from Fossil Fuels.
8. Air Pollution and Energy Use.
9. Global Warming and Thermal Pollution.
10. Electricity: Circuits and Superconductors.
11. Electromagnetism and the Generation of Electricity.

12. Electricity from Solar, Wind, and Hydro.
13. The Building Blocks of Matter:
14. Nuclear Power: Fission.
15. Effects and Uses of Radiation.
16. Future Energy Alternatives: Fusion.
17. Biomass: From Plants to Garbage.
18. Tapping the Earth's Heat: Geothermal Energy.
19. A National and Personal Commitment.

Prepared by Edwin Fohtung, Spring 2018.

Course Number and Name: Physics 305V, Search for Water in the Solar System

Credits and Contact Hours: 3 credits (two 75-minute lectures each week); an additional 2 contact hours each week (during office hours).

Instructor or Course Coordinator Name: Tom Hearn

Textbook: none required

a) other supplemental materials:

C.H. Langmuir and W, Broecker, *How to build a habitable planet: The story of the Earth from the big bang to humankind*, 2012, ISBN: 978-0602240063

T. Encrenaz, *Searching for water in the universe*, 2007, ISBN: 978-0-387-34174-3.

Specific Course Information:

a) catalog description: Examines the formation, abundance, and ubiquity of water in our Solar System stemming from comets, Martian and Lunar poles, Earth's interior and into the outer reaches of the Solar System. Topics will include nuclear synthesis, Solar System formation, remote sensing, as well as past, present and future NASA missions for water.

b) prerequisites or co-requisites: Viewing a Wider World courses and should be taken in a student's junior and/or senior year.

c) This course is not required for majors in Physics and Engineering Physics, but may be used as an elective.

Specific Goals of the Course:

a) specific outcomes of instruction: This course provides an overview of water on Earth, in the solar system, and in the universe. This includes formation of the solar system and universe. Students should become proficient in combining diverse sources of knowledge and information to discuss interdisciplinary topics including nuclear synthesis, Solar System formation, remote sensing, as well as past, present and future NASA missions for water.

b) related ABET Outcomes: f) Professional Responsibility, h) Societal Impact, i) Lifelong Learning, j) Contemporary Issues.

Brief List of Topics Covered:

1. Scales; Big Bang
2. Nucleosynthesis; Periodic Table
3. Rocky Bodies; Water on terrestrial planets
4. The Solar System: Gas Giants; The Solar System: Icy Giants
5. Planet Formation/Accretion; Newtons Laws
6. Celestial Mechanics; Composition of Atmospheres
7. Elements of planets; Minerals.
8. Rocks; Water Properties.
9. Lakes and Oceans; Ecology.
10. Humans and Water; Habitable Zone.
11. Urey Miller; Chemical Bonding.
12. Vibrations; Detection.
13. Past NASA; Current NASA.
14. Brain Storming; Moon.
15. Mars; Extrasolar.

16. Ice, Snow, and Water on Earth; Water in the Mantle.
17. Water Terrestrial; Outer Solar System.
18. Water and Climate; Life.
19. Pollution.
20. Conservation; Food.
21. Security; Water Security.
22. Student Papers
23. Student Presentations

Prepared by Tom Hearn, Fall 2017.

Course Number and Name: Physics 315 – Intermediate Modern Physics, 3 credits

Credits and Contact Hours: 3 credits (three 50-minute lectures each week); an additional 2 contact hours each week (during office hours)

Instructor or Course Coordinator Name: Matthias Burkardt

Textbook: H. D. Young & R. A. Freedman, *University Physics with Modern Physics*, Pearson/Addison Wesley

a) other supplemental materials: handouts

Specific Course Information:

a) catalog description: an introduction to relativity and quantum mechanics with applications on atoms, molecules, solids, nuclei, and elementary particles.

b) prerequisites or co-requisites: *Prerequisite*: Phys 214 or 216G and Math 291G; *Corequisite*: none

c) This course is required for majors in Physics, Engineering Physics and Chemistry.

Specific Goals of the Course:

a) specific outcomes of instruction: In this course you will learn the key ideas of modern physics which were mostly developed during the 20^{th} century. In addition to discussing how these ideas shaped modern physics, applications to real-life problems are emphasized.

b) related ABET Outcomes: This course addresses Program Outcomes (a) an ability to apply knowledge to physics problems, (f) an understanding of ethical and professional responsibilities, (h) an understanding of the impact of engineering and physics solutions in a global, economic, environmental, and societal context, (i) a recognition of the need for and an ability to engage in life-long learning, and (j) a knowledge of contemporary issues.

Brief List of Topics Covered:

The Michelson Morley experiment (1); The Lorentz transformation (2);

Relativistic momentum and energy (2); General relativity (1);

Blackbody radiation (1); Photoelectric effect (1);

Compton effect and pair creation (1); Rutherford experiment (1);

Atomic spectra, Bohr model, de Broglie waves (1); Schroedinger equation (3);

Chemical Bonds, properties of solids (3); Fermi gas (2);

Radioactivity (1); Nuclear landscape (2);

Nuclear reactions (2); Nuclear reactors. Cerenkov radiation (2);

Nuclear accidents (2); Biological effects of radiation (2);

Standard model of elementary particles and cosmology (3).

Prepared by Matthias Burkardt, Spring 2018.

Course Number and Name: Physics 315L, Experimental Modern Physics

Credits and Contact Hours: 3 credits (two 150-minute labs each week); an additional 2 contact hours each week (during office hours)

Instructor or Course Coordinator Name: Stephen Pate

Textbook: no textbook

a) other supplemental materials: available at https://learn.nmsu.edu

Specific Course Information:

a) catalog description: Elementary laboratory in modern physics which supports the subject matter in PHYS 315.

b) prerequisites or co-requisites: PHYS 214L or 216L *(pre-req)*; PHYS 315 *(co-req)*

c) This course is required for all majors in Physics and Engineering Physics.

Specific Goals of the Course:

a) specific outcomes of instruction: Students perform a series of classic experiments in quantum physics and apply techniques of measurement, interpretation, and presentation of experimental data.

b) related ABET Outcomes: PHYS 315L addresses the following Program Outcomes:

b) Design and conduct experiments, as well as analyze and interpret data

c) Design a system, component, or process to meet desired needs within realistic constraints

d) Function on multidisciplinary teams

f) Have an understanding of professional and ethical responsibilities

g) Communicate effectively

k) Use techniques, skills and modern tools necessary for engineering and physics practice

Brief List of Topics Covered:

The students work in teams of 3-4 people. Each team performs 8 experiments over the course of the semester. The first experiment concerns the uncertainties in counting experiments, and all students write a report on this measurement. Then comes a series of 6 short experiments; individual students are assigned to write a report for the whole team; each student writes two reports in total. Then comes a final longer experiment, lasting several weeks. The team writes a design report for this experiment, then performs the measurement, analyses the data, and makes presentation to the entire class during the last few lab meetings.

The First Experiment (done by all teams; all students write an individual report)

1. Counting Statistics

Short Experiments (each team does 6 of these; team reports written by individual members)

2. Atomic Spectroscopy
3. Electron Diffraction
4. Planck's Constant – Photoelectric Effect
5. The Speed of Light
6. Quantization of Atomic Energy Levels – Franck-Hertz Experiment
7. Nuclear Magnetic Resonance
8. Electrical Conductivity of Metals and Semi-conductors

9. Ruckardt's Tube – specific heat ratio in gases

Long Experiments (done by one team only; requires design report, and final results presentation, done by the whole team)

10. The Hall Effect
11. X-Ray Diffraction
12. Charge of the Electron – Millikan Oil Drop Experiment
13. The Zeeman effect
14. Gamma-Ray Spectroscopy
15. Rutherford Scattering and the Range of Alpha Particles in Matter

Prepared by Stephen Pate, Spring 2018.

Course Number and Name: Physics 395, Intermediate Mathematical Methods of Physics

Credits and Contact Hours: 3 credits (two 75-minute lectures each week); an additional 2 contact hours each week (during office hours)

Instructor or Course Coordinator Name: Stephen Pate

Textbook: HELM Workbooks, available at https://learn.nmsu.edu

a) other supplemental materials: available at https://learn.nmsu.edu

Specific Course Information:

a) catalog description: Introduction to the mathematics used in intermediate-level physics courses. Topics include vector calculus, curvilinear coordinates, matrices, linear algebra, function spaces, partial differential equations, and special functions.

b) prerequisites or co-requisites: MATH 291 *(pre-req)*, MATH 392 *(pre/co-req)*

c) This course is required for all majors in Physics and Engineering Physics.

Specific Goals of the Course:

a) specific outcomes of instruction: Students should become proficient at these advanced mathematical topics so that they will easily understand the interplay between the mathematical tools and physics concepts. The advanced mathematics should become an aid to understanding, and not a barrier.

b) related ABET Outcomes: PHYS 395 addresses Program Outcome k) *use techniques, skills and modern tools necessary for engineering and physics practice.*

Brief List of Topics Covered:

The course will cover four major topic areas:

1. Vector Calculus -- HELM Chapters 28,29 (11 lectures)
2. Complex Numbers -- HELM Chapter 10 (2 lectures)
3. Linear Algebra -- HELM Chapters 7, 22 (9 lectures)
4. Differential Equations – HELM Chapter 25 (5 Lectures)

Prepared by Stephen Pate, Spring 2018.

Course Number and Name: Physics 451, Intermediate Mechanics I

Credits and Contact Hours: 3 credits (three 50-minute lectures each week); an additional 2 contact hours each week (during office hours)

Instructor or Course Coordinator Name: Lauren Waszek

Textbook: Fowles and Cassiday, Analytical Mechanics 7th Edition, Brooks and Cole

Specific Course Information:

a) catalog description: Vector calculus, Lagrangian and Hamiltonian formulations of Newtonian mechanics. Topics include central force motion, dynamics of rockets and space vehicles, rigid body motion, noninertial reference frames, oscillating systems, relativistic mechanics, classical scattering, and fluid mechanics.

b) prerequisites or co-requisites: PHYS 213 or 215G, MATH 291G *(pre-reqs);* MATH 392 *(pre-/co-reqs)*

c) This course is required for Physics and Engineering Physics (EP) majors with Electrical and Chemical concentrations and is a possible elective for Mechanical or Aerospace Concentrations.

Specific Goals of the Course:

a) specific outcomes of instruction: This course provides a more comprehensive understanding of the fundamental ideas underlying classical mechanics, including Newton's laws and conservation laws. It incorporates mathematical techniques for application of these ideas to solving problems, and alternative formulations of these basic principles (Lagrangian and Hamiltonian) based on the principle of least action and on the calculus of variations.

b) related ABET Outcomes: PHYS 451 addresses Program Outcomes (e) develop an ability to identify, formulate, and solve engineering problems, (f) an understanding of ethical and professional responsibilities, (h) an understanding of the impact of engineering and physics solutions in a global, economic, environmental, and societal context, (i) a recognition of the need for and an ability to engage in life-long learning, and (j) a knowledge of contemporary issues.

Brief List of Topics Covered:

The course covers all material from Chapters 1-10 of the textbook. Approximate numbers of lectures spent on each chapter are indicated.

1. Chapter 1: Fundamental Concepts: Vectors, 2.5
2. Chapter 2: Newtonian Mechanics: Rectilinear Motion of a Particle, 4
3. Chapter 3: Oscillations, 3
4. Chapter 4: General Motion of a Particle in Three Dimensions, 2.5
5. Chapter 5: Non-Inertial Reference Systems, 2.5
6. Chapter 6: Gravitation and Central Forces, 4.5
7. Chapter 7: Dynamics of Systems and Particles, 3.5
8. Chapter 8: Mechanics of Rigid Bodies: Planar Motions, 4
9. Chapter 9: Motions of Bodies in Three Dimensions, 4
10. Chapter 10: Lagrangian Mechanics, 5
11. Examination review sessions: 4
12. Mid-terms: 2

Prepared by Lauren Waszek, Fall 2017.

Course Number and Name: Physics 454, Intermediate Modern Physics I

Credits and Contact Hours: 3 credits (two 75-minute classes each week); an additional 2 contact hours each week (during office hours)

Instructor or Course Coordinator Name: Michael Engelhardt

Textbook: J. S. Townsend, *A Modern Approach to Quantum Mechanics*, University Science Books, 2nd edition, 2012.

a) other supplemental materials: none

Specific Course Information:

a) catalog description: Introduction to quantum mechanics, focusing on the role of angular momentum and symmetries, with application to many atomic and subatomic systems.

b) prerequisites or co-requisites: PHYS 315 *(pre-req.)*, PHYS 395 *(co-req.)*, and MATH 392 *(co-req.)*

c) This course is required for majors in Physics and Engineering Physics

Specific Goals of the Course:

a) specific outcomes of instruction: This course provides foundations of quantum mechanics and related phenomena. It is an integral part of the upper-division physics core, which includes PHYS 451, 454&455, 461&462, and PHYS 480. Students should become proficient in solving a wide range of problems based on a quantum state vector description of systems, an operator formulation of observables, and Schrödinger's equation, including intrinsic spin and motion in one dimension.

b) related ABET Outcomes: PHYS 454 addresses Program Outcome e) Problem Solving: *an ability to identify, formulate, and solve engineering and physics problems*.

Brief List of Topics Covered:

The course covers material from Chapters 1-7 of Townsend's textbook.

1. Chapter 1: Stern-Gerlach Experiments, Sec. 1-6
2. Chapter 2: Rotation of Basis States and Matrix Mechanics, Sec. 1-8
3. Chapter 3: Angular Momentum, Sec. 1-8
4. Chapter 4: Time Evolution, Sec. 1-4,6,7
5. Chapter 5: A System of Two Spin-1/2 Particles, Sec. 1-3,7,8
6. Chapter 6: Wave Mechanics in One Dimension, Sec. 1-11
7. Chapter 7: One-Dimensional Harmonic Oscillator, Sec. 1-11

Prepared by Michael Engelhardt, Fall 2017.

Course Number and Name: Physics 455 – Intermediate Modern Physics II, 3 credits

Credits and Contact Hours: 3 credits (two 75-minute lectures each week); an additional 2 contact hours each week (during office hours)

Designation: Required for undergraduate Physics and Engineering Physics majors.

Instructor or Course Coordinator Name: Matthias Burkardt

Textbook: J.S. Townsend: A Modern Approach to Quantum Mechanics, University Science Books 2000.

a) other supplemental materials: none

Specific Course Information:

a) catalog description: continuation of subject matter of PHYS 454. Specific topics include rotation and translation in three dimensions, solution of central potential problems, perturbation theory, physics of identical particles, scattering theory, and the interaction between photons and atoms.

b) prerequisites or co-requisites: *Prerequisite*: PHYS 454

c) This course is required for majors in Physics and Engineering Physics.

Specific Goals of the Course:

a) specific outcomes of instruction: In this course you will learn how to apply the postulates of quantum mechanics to solve simple quantum mechanics problems.

b) related ABET Outcomes: Students should develop an ability to identify, formulate, and solve engineering problems that involve quantum phenomena.

Brief List of Topics Covered:

1. The postulates of quantum mechanics (2)
2. One-dimensional Schroedinger equation; particle in a box (3)
3. The harmonic oscillator (4)
4. The two-body problem (3)
5. Three-dimensional Schroedinger equation; Central potentials (4)
6. Approximate methods; perturbation theory, variational method (4)
7. The chemical bond; properties of solids (3)
8. Identical particles (2)
9. Review (1)

Three midterm quizzes; two-hour final quiz during exam week.

Prepared by Matthias Burkardt, Spring 2018.

Course Number and Name: Physics 461, Intermediate Electricity and Magnetism I

Credits and Contact Hours: 3 credits (three 50-minute lectures each week); an additional 2 contact hours each week (during office hours)

Instructor or Course Coordinator Name: Heinz Nakotte

Textbook: D.J. Griffiths, *Introduction to Electrodynamics*, 4th edition, Prentice Hall, 2013

a) other supplemental materials: C.A. Balanis, *Advanced Engineering Electromagnetics*,

2nd edition, John Wiley & Sons, 2012.

Specific Course Information:

a) catalog description: The first part of a two-course sequence in classical electrodynamics. Covered topics include static electric and magnetic fields, Laplace's and Poisson's equations, electromagnetic work and energy, Lorentz force, Gauss's, Biot-Savart, and Ampere's laws, Maxwell's equations, as well as electric and magnetic fields in matter.

b) prerequisites or co-requisites: PHYS 214 or 216G or equivalent and MATH 291G *(pre-reqs);* MATH 392 and PHYS 395 *(pre-/co-reqs)*

c) This course is required for all majors in Physics and Engineering Physics.

Specific Goals of the Course:

a) specific outcomes of instruction: This course provides the fundamental knowledge of electrodynamics and related phenomena. It is an integral part of the upper-division physics core, which includes PHYS 451, 454&455 and 461&462. Students should become proficient in a wide range of problems of electro- and magnetostatics, including dielectrics and magnetic materials.

b) related ABET Outcomes: PHYS 461 addresses Program Outcomes (e) develop an ability to identify, formulate, and solve engineering problems, (f) an understanding of ethical and professional responsibilities, (h) an understanding of the impact of engineering and physics solutions in a global, economic, environmental, and societal context, (i) a recognition of the need for and an ability to engage in life-long learning, and (j) a knowledge of contemporary issues.

Brief List of Topics Covered:

The course covers all of the material from Chapters 1-6 of Griffiths' textbook, and it provides occasional supplemental material from Balanis' textbook. Number of lectures spend on each section are indicated.

Chapter 1: Vector Analysis (3)

1.1. Vector Algebra *(1/2 lecture)*
1.2. Differential Calculus *(1/2)*
1.3. Integral Calculus *(1/2)*
1.4. Curvilinear Coordinates *(1/2)*
1.5. The Dirac Delta Function *(1/2)*
1.6. The Theory of Vector Fields *(1/2)*

Chapter 2: Electrostatics (7)

2.1. The Electric Field *(1)*
2.2. Divergence and Curl of Electrostatic Field *(2)*
2.3. Electric Potential *(1)*

2.4. Work and Energy in Electrostatics *(1)*
2.5. Conductors *(2)*
Chapter 3: Special Techniques (6)
3.1. Laplace's Equation *(1)*
3.2. The Method of Images *(1)*
3.3. Separation of Variables *(2)*
3.4. Multipole Expansion *(2)*
Chapter 4: Electric Fields in Matter (7)
4.1. Polarization *(1)*
4.2. The Field of a Polarized Object *(1)*
4.3. The Electric Displacement *(2)*
4.4. Dielectrics *(3)*
Chapter 5: Magnetostatics (5)
5.1. The Lorentz Force Law *(1)*
5.2. The Biot-Savart Law *(2)*
5.3. The Divergence and Curl of B *(1)*
5.4. Magnetic Vector Potential *(2)*
Chapter 6: Magnetic Fields in Matter (6)
6.1. Magnetization *(1)*
6.2. The Field of a Magnetized Object *(1)*
6.3. The Auxiliary Field H *(2)*
6.4. Linear and Nonlinear Media *(2)*
Student Presentations (4)

Prepared by Heinz Nakotte, Fall 2017.

Course Number and Name: Physics 462, Intermediate Electricity and Magnetism II

Credits and Contact Hours: 3 credits (two 75-minute lectures each week); an additional 2 contact hours each week (during office hours)

Instructor or Course Coordinator Name: Robert Cooper

Textbook: D.J. Griffiths, *Introduction to Electrodynamics*, 4th edition, Prentice Hall, 2013

a) other supplemental materials: R.K. Wangsness, *Electromagnetic Fields*, 2nd edition, John Wiley & Sons, 1986.

C.A. Balanis, *Advanced Engineering Electromagnetics*, 2nd edition, John Wiley & Sons, 2012.

Specific Course Information:

a) catalog description: Continuation of subject matter of PHYS 461. Covered topics include Maxwell's equations and their applications, electromagnetic waves, reflection, refraction, dispersion, radiating systems, interference and diffraction, as well as Lorentz transformations and relativistic electrodynamics. May be repeated up to 3 credits.

b) prerequisites or co-requisites: C- or better in PHYS 461.

c) This course is required for all majors in Physics and Engineering Physics.

Specific Goals of the Course:

a) specific outcomes of instruction: This is a required course for physics and engineering physics student, and it is a continuation of topics introduced in PHYS 461: Introduction to Electricity and Magnetism I. In this course, the effect of moving charges will be explored in electromotive force, induction, Maxwell's equations, conservation laws, electromagnetic waves in vacuum and in matter, absorption and dispersion, waveguides, dipole radiation, and relativistic electrodynamics. Due to the compounding use of advanced mathematics, a secondary objective to this course is to continue developing the use of mathematics in practical physics problems.

b) related ABET Outcomes: This course addresses Program Outcomes (e) develop an ability to identify, formulate, and solve engineering problems, and possibly (f) an understanding of ethical and professional responsibilities, (h) an understanding of the impact of engineering and physics solutions in a global, economic, environmental, and societal context, (i) a recognition of the need for and an ability to engage in life-long learning, and (j) a knowledge of contemporary issues.

Brief List of Topics Covered:

The course covers the material from Chapters 7-12 of Griffiths' textbook, and it provides occasional supplemental material from Balanis' and Wangsness' textbooks. The number of lectures spent on each section are indicated.

Chapter 7: Electrodynamics (3)

7.1. Electromotive Force *(1/2 lecture)*

7.2. Electromagnetic Induction *(1)*

7.3. Maxwell's Equations *(1-1/2)*

Chapter 8: Conservation Laws (2)

8.1. Charge and Energy *(1/2)*

8.2. Momentum *(1/2)*

8.3. Magnetic Forces Do No Work *(1)*

Chapter 9: Electromagnetic Waves (5)

9.1. Waves in One Dimension *(1)*

9.2. Electromagnetic Waves in Vacuum *(1)*

9.3. Electromagnetic Waves in Matter *(1)*

9.4. Absorption and Dispersion *(1)*

9.5. Guided Waves *(1)*

Chapter 10: Potentials and Fields (3)

10.1. The Potential Formulation *(1)*

10.2. Continuous Distributions *(1)*

10.3. Point Charges *(1)*

Chapter 11: Radiation (4)

11.1. Dipole Radiation *(2)*

11.2. Point Charges *(2)*

Chapter 12: Relativity (4)

12.1. The Special Theory of Relativity *(1-1/2)*

12.2. Relativistic Mechanics *(1)*

12.3. Relativistic Electrodynamics *(1-1/2)*

Student Presentations (2)

Chapters 1-6 Review (2)

Exam Reviews (3)

Midterm (1)

ETS MFT post-testing (1)

Prepared by Robert Cooper, Spring 2018.

Course Number and Name: Physics 468, Intermediate X-ray Diffraction, Fall 2017

Credits and Contact Hours: 3 credits (two 75-minute lectures each week; lectures are cancelled occasionally to give students an opportunity for hands-on experiments in x-ray diffraction).

Instructor's or Course Coordinator's Name: Stefan Zollner

Textbook: Choose one: (1) Powder x-ray diffraction: Cullity & Stock, Elements of X-Ray Diffraction, 3rd edn, Pearson, 2001 (2) X-ray reflectance and reciprocal space maps: Holy, Pietsch & Baumbach, High-Resolution X-Ray Scattering: From Thin Films to Lateral Nanostructures, 2nd edn, Springer, 2004 (3) Crystallography: Rohrer, Structure and Bonding in Crystalline Materials, Cambridge University Press, 2001.

a) other supplemental materials: Hand-outs from the instructor and various sources, especially Wikipedia. American Institute of Physics Style Manual. Selected original research journal articles. These materials are made available to students on the course learning management system (Canvas).

Specific Course Information:

a) catalog description: Introduction to x-ray diffraction and reflectivity spectra. Topics include X-ray sources and detectors, atomic spectra, characteristic x-rays, thermionic emission, synchrotron radiation, instrument components, and beam conditioners.

b) prerequisites or co-requisites: a C- or better in PHYS 315 and PHYS 315L *(pre-req.)*

c) This course is a possible technical elective for majors in Physics and Engineering Physics with any of the concentrations. In general, it is cross-listed with PHYS 568, a slightly more advanced course taken by physics graduate students. The class material covered in PHYS 468 and PHYS 568 is the same for both undergraduate and graduate students; however, graduate students are required to do additional (more difficult) assignments. This course is also cross-listed as CHME 488/588, a technical elective for students in chemical and materials engineering.

Specific Goals of the Course:

a) specific outcomes of instruction: This course introduces instrumentation and measurement concepts for both powder and high-resolution x-ray diffraction. It also provides a basic introduction into crystallography, including crystal symmetry and reciprocal space. Students gained hands-on experience with modern equipment, were introduced to the original research literature, performed experiments, presented their results in class, and wrote a report formatted like an article in a research journal.

b) related ABET Outcomes: PHYS 468 addresses Program Outcomes: b) *an ability to design and conduct experiments, as well as to analyze and interpret data*, d) *an ability to function on multidisciplinary teams*, f) *an understanding of professional and ethical responsibility*, g) *an ability to communicate effectively (orally, written)*, k) *an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.*

Brief List of Topics Covered:

Below is the list of topics covered over the course of the semester. The number of lectures for each group of topics is given in parentheses.

1. Syllabus, course overview, pretest, photoelectric effect (1)
2. Rubric for final report and in-class presentations (1)
3. Spectroscopy, thermionic emission, Schottky emission, Bremsstrahlung, Bohr model, characteristic x-rays, core levels, x-ray absorption, x-ray tubes (2)
4. Optical constants in the x-ray regime, experimental setup for powder diffraction, Huygens' principle, Bragg's Law, Du Mond diagram, beam conditioners, diffraction methods, diffractometers and reflectometers (2)
5. Linear algebra, groups, fields, vector spaces, inner product, dual space, dual basis, reciprocal space (2)
6. Miscibility, phase diagrams, two-dimensional lattices, chemical bonding, radius ratio, packing density (2)
7. Crystal=lattice+basis, Bravais lattices, rhombohedral and hexagonal lattice, crystal structures, points, Miller indices, directions (2)
8. Space and point groups, Wyckoff positions, Bilbao crystallographic server (1)
9. Structure factors, intensities of power diffraction peaks, examples (rutile, perovskite, zinc blende, rocksalt), atomic form factor, Lorentz-polarization factor, Debye-Waller factor, multiplicity (4)
10. Pseudomorphic layers, stress and strain, symmetric and asymmetric reflections, reciprocal space maps (4)
11. Presentations from students about their experiments (2)
12. Experiments (equivalent to seven class periods)

Prepared by Stefan Zollner, Fall 2017.

Course Number and Name: Physics 471, Modern Experimental Optics, Fall 2016

Credits and Contact Hours: 3 credits (two 150-minute lab sessions each week).

Instructor's or Course Coordinator's Name: Stefan Zollner

Textbook: Harland G. Tompkins and James N. Hilfiker, *Spectroscopic Ellipsometry: Practical Application to Thin Film Characterization,* Momentum Press, New York, 2016 (ISBN-13: 978-1606507278).

a) other supplemental materials: Hand-outs from the instructor and various sources, especially Wikipedia. American Institute of Physics Style Manual. Selected original research journal articles. These materials are made available to students on the course learning management system (Canvas).

Specific Course Information:

a) catalog description: Advanced laboratory experiments in optics related to the material presented in PHYS 473 (Introduction to Optics).

b) prerequisites or co-requisites: a C- or better in PHYS 315 and PHYS 315L *(pre-req.)*

c) This course is a possible technical elective for majors in Physics and Engineering Physics with any of the concentrations. In general, it is cross-listed with PHYS 571, a slightly more advanced course taken by physics graduate students. The class material covered in PHYS 471 and PHYS 571 is the same for both undergraduate and graduate students; however, graduate students are required to do additional (more difficult) assignments. This course meets the advanced laboratory requirement for some degree options.

Specific Goals of the Course:

a) specific outcomes of instruction: Students perform a series of experiments covering a broad range of physics topics, especially using optical spectroscopy, x-ray diffraction, and x-ray reflectance instruments. Students apply the principles and concepts covered in their upper-division physics coursework. The purpose of this laboratory is to illustrate the physical principles discussed in lectures, to gain skill in asking and answering scientific questions, and in using scientific reasoning. Students will also develop experimental and teamwork skills and demonstrate professional responsibility. Students will research topics online, in textbooks and journals, and on the internet (Wikipedia), write reports (written like physics journal articles) and give presentations with slides (similar to a conference presentation). This course provides a culminating major design experience (for physics majors) based on the knowledge and skills acquired in earlier course work that incorporates appropriate standards and multiple constraints. Students will solve open-ended and ill-posed problems and present their findings.

b) related ABET Outcomes: PHYS 471 addresses Program Outcomes: (c) An ability to apply the engineering design process to produce solutions that meet specified needs with consideration for public health and safety, and global, cultural, social, environmental, economic, and other factors as appropriate to the discipline. (b) An ability to develop and conduct appropriate experimentation, analyze, and interpret data, and use engineering judgment to draw conclusions. (g) An ability to communicate effectively with a range of audiences. (f) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. (i) An ability to recognize the ongoing need to acquire new knowledge, to choose appropriate learning strategies, and to apply this knowledge. (d) An ability to function effectively as a member or leader of a team and (k) an ability to achieve the goals, plans tasks, meets deadlines, and creates a collaborative and inclusive environment,

Brief List of Topics Covered:

Below is the list of experiments offered to students over the course of the semester. Students are required to perform three individual short experiments and three team-based long experiments

Short experiments:

- Transmission and reflection of glasses (NIR/visible/QUV)
- Transmission and reflection of glasses (infrared)
- Powder x-ray diffraction of rocksalt crystals
- Determine the thickness of SiO_2 on Si using spectroscopic ellipsometry
- Reflectance of a gold mirror (NIR/VIS/QUV)
- Reflectance of Si and Ge (NIR/VIS/QUV)
- Phonon reststrahlen band of LiF (MIR)
- Phonon reststrahlen band of spinel (MIR)

Long experiments:

- X-ray reflectance
- High-resolution (004) x-ray diffraction
- High-resolution x-ray diffraction for different materials
- Low-temperature ellipsometry and critical-point analysis
- Thermal oxidation of Si by rapid thermal annealing
- Infrared ellipsometry of thick SiO_2 on Si

Prepared by Stefan Zollner, Fall 2016.

Course Number and Name: Physics 475, Advanced Laboratory, Spring 2018

Credits and Contact Hours: 3 credits (two 150-minute lab sessions each week).

Instructor's or Course Coordinator's Name: Jacob Urquidi

Textbook: Practical Electronics for Inventors, 3rd ed. by Paul Scherz and Simon Monk.
ISBN-13: 978-0071771337

> **a) other supplemental materials:** Hand-outs supplemental to the course material including NASA's definitive guide to soldering techniques, data sheets for electronic components, material on radiation detectors, etc.

Specific Course Information:

- **a) catalog description:** Advanced laboratory experiments involving experiments in atomic, molecular, nuclear, and condensed matter physics.
- **b) prerequisites or co-requisites:** a C- or better in PHYS 315 and PHYS 315L *(pre-req.)*
- **c)** This course is cross-listed with PHYS 575, a more advanced course taken by physics graduate students. The class material covered is the same for both undergraduate and graduate students, however, graduate students are required to be more insightful, thorough, and deliver at a higher level of technical difficulty. This course meets the advanced laboratory requirement for some degree options.

Specific Goals of the Course:

- **a) specific outcomes of instruction**: The course focuses on the reality that typical problems are not very well characterized and are almost always open-ended in nature when taken from a scientific point of view. The course addresses the reality that such advanced lines of experimental investigation are not clear-cut nor are the experiments involved typically standardized. This means that experiments need to be designed and many times the ancillary equipment, data collection, and reduction protocols are unique to a given experimental design and desired outcome. To this end, the course focuses on practical experimental design beyond the user's manual, basic electronics techniques, the application of physical computing techniques, using microcontrollers, to control and manage the experimental environment, and data acquisition. A typical example would involve the need of controlling the temperature of a sample during a spectroscopy experiment requiring ancillalry equipment that gives careful ramping, equilibration, and data acquisition that is unique to each region; perhaps even control of the main instrumentation system as well.

- **b) related ABET Outcomes:** PHYS 475 addresses Program Outcomes: *(b) experimental training (c) design abilities (d) teamwork (f) professional responsibility and (k) technical know-how*

Brief List of Topics covered:

- Spectroscopic methods and techniques using EM-radiation of different wavelengths
- Diffraction methods and techniques using X-rays

- The role of computer modeling
- Introduction to Physical Computing; controlling your environment
- Introduction to Micro-controllers and applied electronics for controlling experimental parameters
    - Theory
    - Programming
    - Practical Techniques and designs
    - Implementation

The laboratory environment for PHYS 475 is collaborative and team-work based. The students are presented with a combination of hands-on lectures, short term projects, term projects. The students are teamed up with another student at their bench but must do individual work. The class as a whole is strongly encouraged to cross collaborate. This helps with students solidifying their knowledge, learning not to be shy about asking questions, and helps with the development of unique solutions. The instructor also performs the tasks assigned so that the students can experience first-hand that things do not always go smoothly. Experience does not exempt one from frustrating difficulties. The different threads include the following:

- The students are required to keep a proper research notebook of all progress and it is checked and commented upon regularly in order to develop proper techniques and discipline in keeping track of scientific/technical progress.
- The students are presented with increasingly difficult small projects which allow them to develop the skill to measure, keep track of, and manipulate experimental parameters like temperature, pressure, vacuum, distance, etc. The projects must be built, demonstrated, and the student must field questions from the students and instructor. The students' notebook section on the project is also taken into account.
- The students are presented with a choice of a technical Term Project which must be designed, built, integrated, then presented/demonstrated at the end of the semester in front of the class.
- Each student must come up with an individual project (instructor approved) that incorporates and demonstrates in a novel way some of the techniques learned in class. This project must be completely self-designed, built, and then presented/demonstrated at the end of the semester in front of the class.

Prepared by Jacob Urquidi, Spring 2018.

Course Number and Name: Physics 476, Computational Physics

Credits and Contact Hours: 3 credits (two 75-minute lectures each week); one additional contact hour each week (during office hours)

Instructor or Course Coordinator Name: Boris Kiefer

Textbook: M. Hjorth-Jensen, *Computational Physics*, University of Oslo, 2012

other supplemental materials: W. H. Press, S. A. Teukolsky, W. T. Vetterling, and B. P. Flannery, *Numerical Recipes in Fortran. The Art of Scientific Computing, 2nd Edition*, Cambridge University Press, 1992. M. Abramowitz and I. A. Stegun, *Handbook of Mathematical Functions*, Dover Publications, Inc. 1965. Additional in-depth materials are available as needed as pdf files on the file server for the course.

Specific Course Information:

a) catalog description: An introduction to finite difference methods, Fourier expansions, Fourier integrals, solution of differential equations, Monte Carlo calculations, and application to advanced physics problems.

b) prerequisites or co-requisites: PHYS 150 or equivalent and MATH 392 *(pre-reqs)*.

c) This is a required course for majors in Physics and Engineering Physics (EP) with the Electrical Engineering concentration. It is a possible elective for other EP concentrations.

Specific Goals of the Course:

a) specific outcomes of instruction: a) specific outcomes of instruction: Students should become proficient in the higher-level methods of treating physics problems with a computer. The course provides an in-depth study of computational physics.

related ABET Outcomes: c) develop the ability to design a system, component, or process to meet desired needs within realistic constraint such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. k) develop the ability to use techniques, skills, and modern engineering tools necessary for engineering practices.

Brief List of Topics Covered:

The course covers all of the material from Chapters 1-11 of Hjorth-Jensen, and it provides occasional supplemental material from Numerical Recipes and The Handbook of Mathematical Functions and reading material for later chapters. Number of lectures spend on each section are indicated.

Chapter 1: Introduction (1)
Paradigms of scientific programming *(1/2)*
Scientific visualization *(1/2)*
Chapter 2: Numbers on Computers (1)
2.3. Machine numbers and round-off errors (1)
2.4. Computation of exp(-x).
Chapter 3: Interpolation (1)
3.2. Interpolation/extrapolation *(1/2)*
3.1. Finite Differences *(1/2)*
Chapter 5: Linear Algebra (2)
6.4. Linear systems *(1)*
6.5. Spline interpolation *(1/2)*
5.6. Iterative methods *(1/2)*

Chapter 4: Root Finding (2)
4.3. Secant, bisection, bracketing *(1)*
4.4. Brent, Dekker, Newton-Raphson method, multi-dimensions *(1)*
Chapter 5: Integration (2)
5.1. Classical quadrature *(1/2)*
5.2 Adaptive time step *(1/2)*
5.3 Gaussian Quadrature *(1)*
Chapter 7: Eigensystems (2)
7.2. Eigensystem problems *(1/2)*
7.4. Jacobi method, sparse matrices *(1/2)*
Supplementary topic QR/QL algorithm *(1)*
Chapter 8: Ordinary Differntial Equations (2)
8.3. Leapfrog algorithm, conservation laws (1)
8.4. Runge-Kutta method, time step control, classical dynamical systems *(1)*
Chapter 9: Two point boundary value problems (2)
9.2. Shooting method *(1)*
9.3. Numerical implementation; matching *(1)*
Chapter 10: Partial Differential Equations (2)
10.2. FTCS, BTCS, Crank-Nicholson, Numerical stability *(1)*
10.3. Laplace and Poisson's equation *(1/2)*
Supplementary topic: time-dependent Schroedinger equation *(1/2)*.
Chapter 11: Monte Carlo Method (4)
11.3. Random number generators, radioactive decay *(1)*
11.2. Integration, error estimates *(1)*
11.4. Sampling theorem, rejection and acceptance techniques *(1)*
12.5. Metropolis algorithm, 1-D ideal gas; multidimensional integrals *(1)*
Data Description and Modelling (2)
Supplementary topic: Linear models *(1)*
Supplementary topic: Non-linear models; Levenberg-Marquardt *(1)*
Min/Max and Global Minimization (2)
Supplementary topic: Brent's algorithm, Conjugate gradient; steepest descent, BFGS *(1)*
Supplementary topic: Simulated annealing *(1)*
Fast-Fourier Transform (2)
Supplementary topic: Nyquist frequency, sampling theorem, aliasing *(1)*
Supplementary topic: Interpolation *(1)*
Introduction to Machine Learning (1)
Supplementary topic: Pattern recognition, neural nets, applications *(1)*

Prepared by Boris Kiefer, Spring 2018.

Course Number and Name: Physics 480, Thermodynamics

Credits and Contact Hours: 3 credits (three 50-minute lectures each week); an additional 2 contact hours each week (during office hours)

Instructor or Course Coordinator Name: Stephen Pate

Textbook: Kittel and Kroemer, *Thermal Physics*, 2nd edition, Freeman, 1980

a) other supplemental materials: available at https://learn.nmsu.edu

Specific Course Information:

a) catalog description: Thermodynamics and statistical mechanics. Basic concepts of temperature, heat, entropy, equilibrium, reversible and irreversible processes. Applications to solids, liquids, and gases.

b) prerequisites or co-requisites: PHYS 217, PHYS 315, MATH 291 *(all pre-reqs)*

c) This course is required for all majors in Physics, and those in Engineering Physics with concentration in Electrical Engineering. It is an elective for majors in Engineering Physics with a concentration in Aerospace, Chemical or Mechanical Engineering.

Specific Goals of the Course:

a) specific outcomes of instruction: PHYS 480 is an introduction to thermodynamics and statistical physics. The material is taught from the point of view of quantum mechanics from the very beginning, but the knowledge of quantum mechanics required of the student is in fact very slight. We will cover the fundamental topics of equilibrium thermodynamics -- entropy, temperature, energy, heat, reversible and irreversible processes -- and see applications to some simple systems.

b) related ABET Outcomes: This course addresses Program Outcomes (e) develop an ability to identify, formulate, and solve engineering problems, and possibly (f) an understanding of ethical and professional responsibilities, (h) an understanding of the impact of engineering and physics solutions in a global, economic, environmental, and societal context, (i) a recognition of the need for and an ability to engage in life-long learning, and (j) a knowledge of contemporary issues.

Brief List of Topics Covered:

The course covers material from Chapters 1-10 of the Kittel and Kroemer textbook. The number of lectures spent on each section are indicated.

1. Chapter 1: States of a Model System (4)
2. Chapter 2: Entropy and Temperature (3)
3. Chapter 3: Boltzmann Distribution and Helmholtz Free Energy (4)
4. Chapter 4: Thermal Radiation and Planck Distribution (5)
5. Chapter 5: Chemical Potential and Gibbs Distribution (3)
6. Chapter 6: Ideal Gas (5)
7. Chapter 7: Fermi and Bose Gases (5)
8. Chapter 8: Heat and Work (4)
9. Chapter 9: Gibbs Free Energy and Chemical Reactions (3)
10. Chapter 10: Phase Transformations (5)

Prepared by Stephen Pate, Spring 2018,

Course Number and Name: Physics 488, Introduction to Condensed Matter Physics

Credits and Contact Hours: 3 credits (two 75-minute lectures each week); an additional 2 contact hours each week (during office hours)

Instructor's or Course Coordinator's Name: Edwin Fohtung

Textbook:

N. W. Ashcroft and N. D. Mermin, Solid State Physics, Thomson Publishing, 1976 *(required)*; Charles Kittel, *Introduction to Solid State Physics*, 8th ed., John Wiley & Sons, 2005 *(recommended)*

a) other supplemental materials: own hand-outs or hand-outs from other sources

Specific Course Information:

a) catalog description: crystal structure, X-ray diffraction, energy band theory, phonons, cohesive energy, conductivities, specific heats, p-n junctions, defects surfaces, and magnetic, optical, and low-temperature properties.

b) prerequisites or co-requisites: PHYS 315*(pre-req)*

c) This course is a possible technical elective for undergraduate majors in Physics and Engineering Physics with any of the concentrations. Moreover, it is cross-listed with PHYS 588, a slightly more advanced course taken by physics graduate students. The class material covered in PHYS 488 and PHYS588; however, graduate students are required to do additional (more difficult) assignments.

Specific Goals of the Course:

a) specific outcomes of instruction: This course provides a general introduction to solid state physics, such as crystal structures, diffraction techniques, type of chemical bonding, energy-band theory, phonons, electronic (transport, thermal, optical and magnetic) properties.

b) related ABET Outcomes: PHYS 488 is expected to address some or all of the following Program Outcomes: e) Problem Solving, f) Professional Responsibility, h) Societal Impact, i) Life-long Learning, and j) Contemporary Issues.

Brief List of Topics Covered:

The course covers material from the following topics. Each module is covered in about one week.

1. Module 1: Crystal Structure
2. Module 2: Coherent X-ray Diffraction Imaging
3. Module 3: Classification of Solids
4. Module 4: Free-Electron Theory of Metals
5. Module 5: Band Structure of Solids
6. Module 6: Lattice Vibrations
7. Module 7: Semiconductors
8. Module 8: Optical Properties
9. Module 9: Magnetic Properties
10. Module 10: Defects in Crystals
11. Module 11: Topological Defects
12. Module 12: Noncrystalline Solids

Prepared by Edwin Fohtung, Fall 2016.

Course Number and Name: Physics 489, Introduction to Modern Materials, Spring 2018

Credits and Contact Hours: 3 credits (two 75-minute lectures each week; lectures are cancelled occasionally to give students an opportunity for hands-on experiments in optical spectroscopy).

Instructor's or Course Coordinator's Name: Stefan Zollner

Textbook: Required: Mark Fox, Optical Properties of Solids, 2nd edition, 2010, Oxford University Press (ISBN-13: 978-0199573370).

a) other supplemental materials: Hand-outs from the instructor and various sources, especially Wikipedia. American Institute of Physics Style Manual. Selected original research journal articles. These materials are made available to students on the course learning management system (Canvas).

Specific Course Information:

a) catalog description: structure and mechanical, thermal, electric, and magnetic properties of materials; modern experimental techniques for the study of materials properties.

b) prerequisites or co-requisites: PHYS 315 *(pre-req.)*

c) This course is a possible technical elective for majors in Physics and Engineering Physics with any of the concentrations. In general, it is cross-listed with PHYS589, a slightly more advanced course taken by physics graduate students. The class material covered in PHYS 489 and PHYS589 is the same for both undergraduate and graduate students; however, graduate students are required to do additional (more difficult) assignments. This course is also cross-listed as CHME 489/589, a technical elective for students in chemical and materials engineering.

Specific Goals of the Course:

a) specific outcomes of instruction: This course is usually customized by the instructor based on personal experience and skills. For this offering (spring 2018), the course focused on the connection between the microscopic structure of materials (atoms, electrons, and their excitations, such as lattice vibrations or electronic bands) and their optical properties (especially the complex refractive index). The course also introduced students to spectroscopic ellipsometry, an optical technique used for process control in advanced manufacturing (especially for semiconductors, thin films, and coatings). Students gained hands-on experience with modern equipment, were introduced to the original research literature, performed experiments, presented their results in class, and wrote a report formatted like an article in a research journal.

b) related ABET Outcomes: PHYS 489 is expected to address some or all of the following Program Outcomes: e) Problem Solving, f) Professional Responsibility, h) Societal Impact, i) Life-long Learning, and j) Contemporary Issues.

Brief List of Topics Covered:

Below is the list of topics covered over the course of the semester. The number of lectures for each group of topics is given in parentheses.

1. Syllabus, course overview, pretest (1)
2. Electromagnetic fields, Maxwell's equations, generalized plane waves, Jones vectors and Stokes parameters (3)
3. Electrostatics and magnetostatics, dielectrics and paramagnets, Lorentz and Drude model, general oscillator models for optical dispersion (Sellmeyer, Cauchy) (3)
4. Optical properties of metals, restrahlen band, Lyddane-Sachs-Teller relation, Berreman effect, plasma oscillations, infrared response of insulators (2)
5. Optical response function, analytical properties of epsilon, Kramers-Kronig transform, Lowndes and Gervais models (2)
6. Einstein coefficients, population inversion and lasers, Fermi's Golden Rule, selection rules (2)
7. Metals, insulators, and semiconductors; free electrons, direct and indirect transitions (2)
8. Electrons and holes in GaAs, band structure of Si and Ge (2)
9. Interband transitions and dielectric function of semiconductors, variation of the dielectric function due to temperature, strain, and doping (2)
10. Excitons, luminescence, electroluminescence (4)
11. Epitaxial growth techniques of thin films, quantum structures, confinement (2)
12. Presentations from students about their experiments (2)
13. Experiments (equivalent to five class periods)

Prepared by Stefan Zollner, Spring 2018.

Course Number and Name: Physics 493, Experimental Nuclear Physics

Credits and Contact Hours: 3 credits (two 150-minute lab sessions each week).

Instructor's or Course Coordinator's Name: Vassili Papavassiliou

Textbook: none required

a) other supplemental materials: Experiment Write-Up and Supplementary Materials are provided on class webpage.

Specific Course Information:

a) **catalog description:** Advanced laboratory in experimental nuclear and particle physics methodology.

b) **prerequisites or co-requisites:** a C- or better in PHYS 315 and PHYS 315L *(pre-req.)*

c) This course is a possible technical elective for majors in Physics and Engineering Physics with any of the concentrations. In general, it is cross-listed with PHYS 593, a more advanced course taken by physics graduate students. This course meets the advanced laboratory requirement for all degree options.

Specific Goals of the Course:

a) **specific outcomes of instruction**: Students perform a series of advanced experiments in nuclear and particle physics and apply techniques of measurement, interpretation, and presentation of experimental data.

b) **related ABET Outcomes:** This course teaches students to:

(b) Design and conduct experiments, as well as analyze and interpret data

(d) Function on multidisciplinary teams

(g) Communicate effectively

(k) Use techniques, skills and modern tools necessary for physics research

Brief List of Topics Covered:

1. Below is the list of lab sessions offered to students over the course of the semester.
2. Introductory remarks (1)
3. Lectures on probability, statistics, error propagation (2)
4. Practical exercise on statistics with radiation counters (2)
5. Radiation safety training (1)
6. Muon decay and lifetime measurement (6)
7. Gamma-gamma correlations with ^{22}Na and ^{60}Co (6)
8. Compton scattering with ^{137}Cs (5)
9. Alpha spectroscopy with Si surface barrier detector and ^{241}Am (5)
10. Attend oral presentations by PHYS 593 graduate students (1)

Prepared by Vassili Papavassiliou, Fall 2017.

Course Number and Name: Physics 495, Mathematical Methods of Physics I

Credits and Contact Hours: 3 credits (three 50-minute classes each week); an additional 2 contact hours each week (during office hours)

Instructor or Course Coordinator Name: Michael Engelhardt

Textbook: The course does not follow a specific textbook; instead, comprehensive type-set notes are provided by the instructor. For reference, students are recommended to consult K. F. Riley, M. P. Hobson and S. J. Bence, *Mathematical Methods for Physics and Engineering,* Cambridge University Press, 3rd edition, 2006.

a) other supplemental materials: Comprehensive type-set notes distributed in hardcopy

Specific Course Information:

a) catalog description: Applications of mathematics to experimental and theoretical physics. Topics selected from: complex variables; special functions; numerical analysis; Fourier series and transforms, Laplace transforms.

b) prerequisites or co-requisites: PHYS 395, MATH 392 *(both pre-reqs.)*

c) This course is an elective for all majors in Physics and Engineering Physics

Specific Goals of the Course:

a) specific outcomes of instruction: Students should become proficient in these advanced mathematical techniques so that they will understand in detail the interplay between the mathematical tools and physics concepts. The advanced mathematics should become an aid to understanding, and not a barrier.

b) related ABET Outcomes: PHYS 495 addresses Program Outcome k) Technical Know-How: *an ability to use the techniques, skills, and modern engineering tools necessary for engineering physics practice.*

Brief List of Topics Covered:

1. Chapter 1: Review of vector analysis
2. Chapter 2: Fourier analysis
3. Chapter 3: Green's functions
4. Chapter 4: Spherical harmonics
5. Chapter 5: Calculus of residues
6. Chapter 6: Tensors
7. Chapter 7: Application: Electromagnetic fields induced by a moving point charge

Prepared by Michael Engelhardt, Fall 2017.

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Aerospace Engineering Courses

Engineering Physics Program

(Bachelor of Science in Engineering Physics)

at

New Mexico State University

Syllabi of Aerospace Engineering Courses

Course Information	**AE 339 Aerodynamics I** 3 credits Required Fall 2017
INSTRUCTOR:	Dr. Fangjun Shu Office: JH224 Phone: 646-2118 email: shu@nmsu.edu
ASSISTANTS:	NA
OFFICE HOURS:	1:30—3:30pm TR or by appointment
CATALOG DESCRIPTION:	Fluid properties, conservation equations, incompressible 2-demensional flow; Bernoulli's equation; similarity parameters; subsonic aerodynamics: lift and drag, analysis and design of airfoils.
PREREQUISITES:	M E 234 or M E 237 and M E 228 or MATH 392
PRE/COREQUISITES	None
TEXT:	*Munson, B. R.,Okiishi, T. H., Huebsch, W.W. & Rothmayer A. P., Fundamentals of Fluid Mechanics, 7th ed., John Wiley, 2013.*
CLASS SCHEDULE:	Lecture: 10:20 a.m. - 11:35 a.m. - TTh - JH 109
GRADES:	Homework: 10% Exam 1&2: 60% (30% each) Final exam: 30%
COURSE OBJECTIVES:	<u>Develop a basic proficiency in</u> • Flow kinematic concepts—streamlines, vorticity and circulation (a,e). • Bernoulli's equation (a,e) • Potential flow theory (a,e) • Applications of mass, momentum and energy conservation laws to fluid mechanics problems (a,e). • Applications of dimensional analysis and dynamic similitude (b,e). • Use of aerodynamic lift and drag coefficients(c,e).
TOPICS COVERED:	• Fluid Statics • Flow Kinematics • Bernoulli's Equation • Review of Vector Calculus • Laplace's equation and potential flows • Control Volume analysis • Similitude, Dimensional Analysis and Modeling • Aerodynamic lift and drag coefficients • Brief introduction of boundary layer theory
RELATIONSHIP TO PROGRAM OUTCOMES:	a ability to apply knowledge of mathematics, science, and engineering b ability to design and conduct experiments, as well as to analyze and interpret data c ability to design a system, component or process to meet desired needs within realistic constraints

Course Information	**AE 339 Aerodynamics I** 3 credits Required Fall 2017
	e ability to identify, formulate, and solve engineering problems
CONTRIBUTION TO PROFESSIONAL COMPONENT:	PC2 1 year math and basic science PC3 1 1/2 years engineering topics (engineering science and design)
RELATIONSHIP TO ABET SPECIFIC CRITERIA:	AE1 knowledge covering aeronautical or astronautical engineering areas AE2 knowledge of some topics from area not emphasized
POLICIES:	• HWs are due on the date specified. **No late HWs will be accepted.** • HW solutions will be posted on CANVAS. • Credit (either a make-up or an average score based on all your other exams) for any missed exam or homework will be given only if: o You inform me before the start of the exam or due time of homework AND o You produce a written signed document giving a valid excuse for your absence. **Otherwise, you will get a zero for the exam/HW missed.**
AUTHOR/DATE:	Fangjun Shu October 2017

Course Information	**AE 362 Orbital Mechanics** 3 credits Required Fall 2017
INSTRUCTOR:	Dr. T. Alan Lovell Office: ABQ Phone: 505-507-3032 email:lovelta@nmsu.edu
ASSISTANTS:	Julia Hoogerhuies
OFFICE HOURS:	by email
CATALOG DESCRIPTION:	Dynamics of exoatmospheric flight of orbiting and non-orbiting bodies; 2-body orbital dynamics and Kepler's laws; orbits in 3 dimensions; orbit determination; orbit design and orbital maneuvers; lunar and interplanetary trajectories.
PREREQUISITES:	MATH 392, ME 237, and ME 261
TEXT:	*Orbital Mechanics for Engineering Students, 3rd ed. by H. D. Curtis (Butterworth-Heinemann, 2013)*
CLASS SCHEDULE:	Lecture: 8:30 a.m. - 9:20 a.m. - MWF – JH213
GRADES:	Grading: Grades will be based on performance on 6 homeworks and 2 exams.
COURSE OBJECTIVES:	• To learn and understand basic principles in orbital mechanics and apply these principles to relevant problems • To master the course content well enough to go on to graduate study or work in the aerospace industry
TOPICS COVERED:	• 2-body orbital dynamics including Kepler's laws and Kepler's equation • Orbits in 3 dimensions and orbital elements • Impulsive orbital maneuvers including Hohmann transfer • Lunar and interplanetary trajectories
RELATIONSHIP TO PROGRAM OUTCOMES:	a ability to apply knowledge of mathematics, science, and engineering e ability to identify, formulate, and solve engineering problems k ability to use the techniques, skills and modern tools necessary for engineering practice
CONTRIBUTION TO PROFESSIONAL COMPONENT:	PC3 1 1/2 years engineering topics (engineering science and design)
RELATIONSHIP TO ABET SPECIFIC CRITERIA:	AE1 knowledge covering aeronautical or astronautical engineering areas AE2 knowledge of some topics from area not emphasized
POLICIES:	• Class materials (lecture slides/HW assignments/etc) will be posted to Canvas. • Homework will be assigned on a near-weekly basis. Generally homework will be due in class one week after it is assigned. Late homework will not

Course Information	**AE 362 Orbital Mechanics** 3 credits Required Fall 2017
	be accepted, and there are no make-up homework assignments. If you do not turn in a homework, then you get a zero for it. The lowest homework grade will be dropped. I will post homework solutions on Canvas after the due date. • There will be two exams during the semester, and one comprehensive final exam. Make-up exams with a valid excuse must be arranged one week before the scheduled exam date. If you can't take the exam for some emergency reason, you still need to notify me prior to the exam if at all possible. If you can't notify me prior to the exam (e.g. emergency hospitalization), notify me as soon as possible after the exam. • While "group" studying for exams is fine, HW assignments should be performed by each student independently. DO NOT seek help on HW problems from anyone except me or the TA. Failure to obey this policy will be considered CHEATING and will be met with appropriate action. • I will entertain any questions asked during class, but the best way to contact me outside of class is by email. This includes notifying me that you will miss class, general questions about the material, etc.
AUTHOR/DATE:	T. Alan Lovell November 6, 2017

Course Information	**AE 363 Aerospace Structures** 3 credits Required Spring 2018
INSTRUCTOR:	Dr. Young Lee Office: JH222 Phone: 646-7457 email: younglee@nmsu.edu
ASSISTANTS:	NA
OFFICE HOURS:	9:30 am - 10:30 am M-F, or by appointment by email
CATALOG DESCRIPTION:	Advanced concepts of stress and strain, introduction to the analysis of aero structures, complex bending and torsion, thin walled sections and shells, computational techniques.
PREREQUISITES:	CE 301
TEXT:	*No textbook will be required, but some useful references include:* • *Donaldson, B. K., Analysis of Aircraft Structures–An Introduction (Chapters 1-14), 2nd Ed., Cambridge Aerospace Series, 2008* • *J. Cutler, Understanding Aircraft Structures–See Canvas and also NMSU Electronic Book service (http://www.netlibrary.com/)*
CLASS SCHEDULE:	Lecture: 11:30 am - 12:20 pm - MWF - JH 210
GRADES:	Homework/ In-Class Excesice 10% Midterm Exam 1 30% Midterm Exam 2 30% Final exam 30%
COURSE OBJECTIVES:	After completing this course, a student should be able to: • Formulate and solve some fundamental linearly-elastic problems; • Apply basic failure theory and perform thermal shock analysis for composite materials; • Perform simplified dynamic loading analysis on aerospace structures; • Calculate various area properties for nonhomogeneous cross-sections of a beam, and their principal values and directions; • Understand the formulations of stresses/strains/deflections in a beam under various loading and boundary conditions.
TOPICS COVERED:	• Fundamental theory of elasticity (stress-strain relations through linearly elastic material behavior, and structural deformation under compatibility conditions) • simplified failure analysis of composite materials • dynamic loading analysis (fatigue/impact design) • thermal shock analysis • stresses, strains and deflections in a beam with closed/open, homogeneous/nonhomogeneous cross-sections under various (longitudinal/transverse, bending, torsional, buckling) loading/boundary conditions

Course Information	**AE 363 Aerospace Structures** 3 credits Required Spring 2018
RELATIONSHIP TO PROGRAM OUTCOMES:	a ability to apply knowledge of mathematics, science, and engineering e ability to identify, formulate, and solve engineering problems k ability to use the techniques, skills and modern tools necessary for engineering practice
RELATIONSHIP TO ABET SPECIFIC CRITERIA:	AE1 knowledge covering aeronautical or astronautical engineering areas AE2 knowledge of some topics from area not emphasized
POLICIES:	• All the lectures will be made self-contained, being posted on Canvas after class. • There will be about 10 in-class exercises. No late submission will be allowed without a prior consent from instructor. The worst two will be dropped off in the final total score. • There will be about 10 homework sets, which will be collected before class starts on the due date. Any submission 10 minutes after class starts will be considered to be late, and will not be accepted without a prior consent from instructor. The worst two will be dropped in the final score. • All exams will be closed-book with a cheat sheet being provided. There will be no make-up exam at all, no matter what. The final letter grades may be on a curve.
AUTHOR/DATE:	Y. Lee January 2018

Course Information	**AE 364 Flight Dynamics and Controls** 3 credits Required Fall 2017
INSTRUCTOR:	Dr. Young Lee Office: JH222 Phone: 646-7457 email: younglee@nmsu.edu
ASSISTANTS:	N/A
OFFICE HOURS:	Open-door policy or by appointment
CATALOG DESCRIPTION:	Fundamentals of airplane flight dynamics, static trim, and stability; spacecraft and missile six degree of freedom dynamics; attitude control of spacecraft.
PREREQUISITES:	Math 392, ME 237, and ME 261
TEXT:	*No textbook* is required, but some references include: • Flight Stability and Automatic Control, 2nd ed., Robert C. Nelson, McGraw-Hill, 1998; • Bossert, D.E., Introduction to Aircraft Flight Mechanics : Performance, Static Stability, Dynamic Stability, Classical Feedback Control, and State-space Foundations, AIAA; • Anderson, Jr., J.D., Introduction to Flight, McGraw-Hill (any Edition); and • Kershner, W.K., The Student's Pilot's Flight Manual: From First Flight to Private Certificate (NMSU E-book)
CLASS SCHEDULE:	Lecture: 1:30 p.m. - 2:20 p.m. - MWF - JH 207
GRADES:	Homework 10% Midterm exam 50% Final exam 20% Class project 20%
COURSE OBJECTIVES:	After completing this course, a student should be able to: • Understand static stability design for longitudinal/lateral/directional flights; • Use the 6-degree-of-freedom, rigid body equations of motion of an aircraft; • Evaluate longitudinal/lateral/directional dynamic stabilities of an airplane; and • Implement some control theories for autopilot design.
TOPICS COVERED:	• Static stability of longitudinal/directional/lateral motions and their control • 6-DOF aircraft equations of motion and stability derivatives • Longitudinal approximation: Phugoid/short-period modes • Lateral/directional approximation: Spiral/rolling/Dutch-roll modes • Fundamentals of automatic control theory: Laplace transform, block diagram, transfer function
RELATIONSHIP TO PROGRAM OUTCOMES:	a ability to apply knowledge of mathematics, science, and engineering e ability to identify, formulate, and solve engineering problems k ability to use the techniques, skills and modern tools necessary for engineering practice

Course Information	**AE 364 Flight Dynamics and Controls** 3 credits Required Fall 2017
CONTRIBUTION TO PROFESSIONAL COMPONENT:	PC3 1 1/2 years engineering topics (engineering science and design)
RELATIONSHIP TO ABET SPECIFIC CRITERIA:	AE1 knowledge covering aeronautical or astronautical engineering areas AE2 knowledge of some topics from area not emphasized
AUTHOR/DATE:	• Y. Lee August 2017

Course Information	**AE 419 Propulsion** 3 credits Required Fall 2017
INSTRUCTOR:	Dr. Ruey-Hung Chen Office: JH 104 Phone: 646-1945 email: chenrh@nmsu.edu
ASSISTANTS:	NA
OFFICE HOURS:	T & R 8:00 a.m.- 10:00 a.m.
CATALOG DESCRIPTION:	Propulsion systems, thermodynamic cycles, combustion, specific impulse; principles of gas turbines, jet engines, and rocket propulsion systems.
PREREQUISITES:	AE 439
TEXT:	*1.Mechanics and Thermodynamics of Propulsion, Hill & Peterson, Addison-Wesley, 1992*
CLASS SCHEDULE:	Lecture: T & R 10:20-11:35, Jett Hall 207
GRADES:	Quizzes 30% Midterm exam 30% Final exam 40%
COURSE OBJECTIVES:	After completing this course, a student should be able to: • Identify & summarize major differences/rationales among different propulsion systems. • Apply principles of mass, momentum and energy to component sections of propulsion. • Evaluate the efficiency and thruster for major propulsion systems.
TOPICS COVERED:	• Introduction & Review of Fundamental Aero/Thermal Sciences and Thermo-chemistry • Performance of aircraft and air-breathing engines • Introduction to Rocket Engines and Electric Propulsion Engines
RELATIONSHIP TO PROGRAM OUTCOMES:	a ability to apply knowledge of mathematics, science, and engineering e ability to identify, formulate, and solve engineering problems k ability to use the techniques, skills and modern tools necessary for engineering practice
CONTRIBUTION TO PROFESSIONAL COMPONENT:	PC3 1 1/2 years engineering topics (engineering science and design)
RELATIONSHIP TO ABET SPECIFIC CRITERIA:	AE1 knowledge covering aeronautical or astronautical engineering areas AE2 knowledge of some topics from area not emphasized
POLICIES:	➢ All exams and quizzes will be open-book & open-notes; no computer or smart phones are allowed during quizzes and exams

Course Information	**AE 419 Propulsion** 3 credits Required Fall 2017
	➢ Questions regarding grading and scores of each exam/quiz should be addressed to the instructor/TA within one week of the date when the exam/quiz is returned; no change or re-grading will be made afterwards. ➢ One midterm and one final: time, date, place, content and format are TBD. ➢ Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act Amendments Act (ADAAA) covers issues relating to disability and accommodations. If a student has questions or needs an accommodation in the classroom (all medical information is treated confidentially), contact: Trudy Luken, Director Student Accessibility Services (SAS) Corbett Center Student Union, Rm. 208 Phone: (575) 646-6840 E-mail: sas@nmsu.edu Website: http://sas.nmsu.edu/ ➢ NMSU policy prohibits discrimination on the basis of age, ancestry, color, disability, gender identity, genetic information, national origin, race, religion, retaliation, serious medical condition, sex, sexual orientation, spousal affiliation and protected veterans status. Furthermore, Title IX prohibits sex discrimination to include sexual misconduct: sexual violence (sexual assault, rape), sexual harassment and retaliation. For more information on discrimination issues, Title IX, Campus SaVE Act, NMSU Policy Chapter 3.25, NMSU's complaint process, or to file a complaint contact: Lauri Millot, Director and Title IX Coordinator Agustin Diaz, Associate Director, Title IX Deputy Coordinator Office of Institutional Equity (OIE) O'Loughlin House, 1130 University Avenue Phone: (575) 646-3635 E-mail: equity@nmsu.edu Website: http://eeo.nmsu.edu/
AUTHOR/DATE:	R. Chen October 2017

Course Information	**AE 424 Aerospace Systems Engineering** 3 credits Required Spring 2018
INSTRUCTOR:	Dr. Terry Armstrong Office: JH136 Phone: 646 - 4947email: oma@nmsu.edu
ASSISTANTS:	N/A
OFFICE HOURS:	Daily after 3pm or by appointment
CATALOG DESCRIPTION:	Basic principles of top down systems engineering and current practice; preliminary and detailed design of aircraft and space vehicles, including requirement, subsystem interaction, and integration, tradeoffs, constraints and non-technical aspects.
PREREQUISITES:	AE 362
TEXT:	The following materials and references will be used: • Lecture presentations and notes • NASA Systems Engineering Materials: http://spacese.spacegrant.org/ • *INCOSE Systems Engineering, Wiley, 4th ed or later*
CLASS SCHEDULE:	Lecture: 10:20 a.m. - 11:35 a.m. - TR - JH 213
GRADES:	Exam 1 30% Exam 2 30% Group Report 10% Group Presentation 10% Exercises/HW 20%
COURSE OBJECTIVES:	• to Introduce the fundamentals of systems engineering theory and practice • to establish the knowledge and comprehension of the value and purpose of systems engineering principles and process • to establish a working knowledge of the methods and tools systems engineers use • to understand the roles of systems engineers and develop the ability contributing to the development of complex aerospace systems
TOPICS COVERED:	• Concepts and theory of systems science and engineering • Requirements development • System design fundamentals and process • Design analysis and optimization • System evaluation, verification and validation • Systems engineering management • Engineering ethics
RELATIONSHIP TO PROGRAM OUTCOMES:	c ability to design a system, component or process to meet desired needs within realistic constraints d ability to function on multidisciplinary teams g ability to communicate effectively

Course Information	**AE 424 Aerospace Systems Engineering** 3 credits Required Spring 2018
RELATIONSHIP TO ABET SPECIFIC CRITERIA:	AE1 knowledge covering aeronautical or astronautical engineering areas AE2 knowledge of some topics from area not emphasized AE3 design competence
POLICIES:	• Since class discussion is a very important method of learning for this course, class participation will be one of the determining factors for grading. • A quiz may be given in each class. A missing quiz cannot be made up later unless the absence was notified to the instructor in advance. • Homework assignments submitted passed the dues dates will receive no credits unless permitted by the instructor.
AUTHOR/DATE:	T.Armstrong January 2018

Course Information	**AE 428 Aerospace Capstone Design** 3 credits Required FA 2017
INSTRUCTOR:	Dr. Young H. Park Office: JH 11 Phone: 646-3092 email: ypark@nmsu.edu
ASSISTANTS:	Edward Rojas
OFFICE HOURS:	8:00 a.m.- 9:00 p.m. MTWRF or by appointment
CATALOG DESCRIPTION:	Team Project-analysis, design, hands-on build test, evaluate.
PREREQUISITES:	AE 424
TEXT:	*NA*
CLASS SCHEDULE:	Lecture: 3:30 p.m. - 6:20 p.m. - M – EC2 103 3:30 p.m. - 6:20 p.m. - W – EC2 103
GRADES:	Class Participation: 20% Individual & team performance: 30% Group Deliverable: 50%
COURSE OBJECTIVES:	• Have experience functioning as mechanical engineer within an engineering design and development group. (d) • Complete a real-life design task – transform a client's needs into a tangible, tractable project definition, and see the project through to completion. (c) • Understand and use a formal engineering design method, with emphasis on building concurrent engineering procedures into the basic design method. (c) • Become proficient in collaboratively preparing and reviewing formal technical design package related to an engineering design including final design binder and report (g)
TOPICS COVERED:	• Participation in a project team • Use of technical tools from past engineering courses • Strengthening of teaming skills • Learning how to apply engineering fundamentals to the design
RELATIONSHIP TO PROGRAM EDUCATIONAL OBJECTIVES:	B ability to formulate, analyze, and creatively participate in the solution of multidisciplinary problems through use of modern engineering C ability to communicate clearly and effectively with fellow engineers, employers and general public D skills needed to fulfill professional duties and responsibilities in teamwork, collegiality, ethics, technical leadership, etc.
RELATIONSHIP TO PROGRAM OUTCOMES:	c ability to design a system, component or process to meet desired needs within realistic constraints d ability to function on multidisciplinary teams g ability to communicate effectively
CONTRIBUTION TO PROFESSIONAL COMPONENT:	PC1 major design experience PC3 1 1/2 years engineering topics (engineering science and design)

Course Information	**AE 428 Aerospace Capstone Design** 3 credits Required FA 2017
RELATIONSHIP TO ABET SPECIFIC CRITERIA:	AE1 knowledge covering aeronautical or astronautical engineering areas AE3 design competence
POLICIES:	• None
AUTHOR/DATE:	Y. Park August 2017

Course Information	***AE 439 Aerodynamics II*** *3 credits* *Required* *Spring 2018*
INSTRUCTOR:	Dr. Fangjun Shu Office: JH104B Phone: 646-3503 email: shu@nmsu.edu
ASSISTANTS:	Jorge Ahumada
OFFICE HOURS:	1:00 p.m.- 3:00 p.m. TR or by appointment
CATALOG DESCRIPTION:	Principles of compressible flow, momentum and energy conservation; thermal properties of fluid; supersonic flow and shock waves; basics of supersonic aerodynamics.
PREREQUISITES:	AE 339, ME 240
TEXT:	*Fundamentals of Aerodynamics, 5th ed., John D. Anderson, Jr.*
CLASS SCHEDULE:	Lecture: 10:30 a.m. - 12:20 a.m. - MWF - JH 213
GRADES:	Homework 10% 2 midterm exams (30% ea.) 60% Final exam 30%
COURSE OBJECTIVES:	After completing this course, a student should be able to: • Apply mass, momentum and energy conservation laws to aerodynamics problems. • Develop concepts of compressible flow, shock and expansion waves. • Solve isentropic, Fanno-line and Rayleigh-line flows in nozzle and gas pipeline design. • Calculate the lift, drag and moment characteristics of thin airfoils and finite wings under both subsonic and supersonic flow regimes.
TOPICS COVERED:	• Review of fluid mechanics for application to aerodynamics. • Conservation laws – mass, momentum and energy. • Inviscid, compressible flow is developed and applied to normal and oblique shocks, and expansion waves. • Compressible flow theory is applied to nozzles, diffusers, and wind tunnels. • Internal compressible flows – Fanno- and Rayleigh- line flows • Inviscid, incompressible flow with application of potential and stream functions. • Incompressible flow over airfoils. Concepts of center-of pressure and aerodynamic center are developed. • Induced drag and Prandtl's lifting-line are developed along with solution methods for finite wings. • Subsonic and supersonic compressible flow is applied to airfoils using linear theory.

Course Information	***AE 439 Aerodynamics II*** *3 credits* *Required* *Spring 2018*
RELATIONSHIP TO PROGRAM OUTCOMES:	a ability to apply knowledge of mathematics, science, and engineering e ability to identify, formulate, and solve engineering problems k ability to use the techniques, skills and modern tools necessary for engineering practice
RELATIONSHIP TO ABET SPECIFIC CRITERIA:	AE1 knowledge covering aeronautical or astronautical engineering areas
POLICIES:	• HWs are due on the date specified. **No late HWs will be accepted.** • HW solutions will be posted on CANVAS. • Credit (either a make-up or an average score based on all your other exams) for any missed exam or homework will be given only if: o You inform me before the start of the exam or due time of homework AND o You produce a written signed document giving a valid excuse for your absence. **Otherwise, you will get a zero for the exam/HW missed.**
AUTHOR/DATE:	F. Shu January 2018

Course Information	**AE 447 Aerofluids Laboratory** 3 credits Required Fall 2017
INSTRUCTOR:	Fangjun Shu Office: JH224 Phone: 646-2118 email: shu@nmsu.edu
ASSISTANTS:	Jorge Arturo Ahumada Lazo jahumada@nmsu.edu
OFFICE HOURS:	1:00 p.m.- 3:00 p.m. T TH or by appointment
CATALOG DESCRIPTION:	Use of subsonic wind tunnels and other flow to study basic flow phenomena and methods of fluid measurement and visualization.
PREREQUISITES:	ME 345 and AE 339
PRE/COREQUISITES	AE 439
TEXT:	None, the following are reference texts • *"Theory and Design for Mechanical Measurements" by R.S Figliola and D.E. Beasley, John Wiley and sons, 1991. This is the book used in ME 345.* • *"Experimental Methods for Engineers" by J.P. Holman, 7th Ed. McGraw-Hill* • *"Particle Image Velocimetry" by M. Raffel, C. Willert, S. Wereley and J. Kompenhans, 2nd Ed. Springer.* • *"Instrumentation, Measurements and Experiments in Fluids" by E. Rathakrishnan, CRC Press*, 2007
CLASS SCHEDULE:	Lecture: 8:30 a.m. - 9:20 a.m. - MW - JH 215 Lab: T: 2:35PM - 5:25PM; W: 12:30PM - 3:20PM; TH: 2:35PM - 5:25PM.
GRADES:	Class Participation 20% Six Laboratory Reports 60% Quizzes 20%
COURSE OBJECTIVES:	After completing this course, a student should be able to: • Initiate the design of an experiment by using dimensional analysis and modeling (a, b, e). • Familiar with data acquisition, processing and visualization (b). • Aware of principles of flow measurement technologies (b). • Write technical reports about aerodynamic experiments and make oral presentations (g).
TOPICS COVERED:	• Dimension analysis and flow similarity • Flow Visualization • Data acquisition and uncertainty analysis • Velocity measurements (Hot wire, LDA and PIV) • Pressure and temperature measurements • Other measurement technology

Course Information	**AE 447 Aerofluids Laboratory** 3 credits Required Fall 2017
RELATIONSHIP TO PROGRAM OUTCOMES:	a ability to apply knowledge of mathematics, science, and engineering b ability to design and conduct experiments, as well as to analyze and interpret data e ability to identify, formulate, and solve engineering problems g ability to communicate effectively
CONTRIBUTION TO PROFESSIONAL COMPONENT:	PC3 1 1/2 years engineering topics (engineering science and design)
RELATIONSHIP TO ABET SPECIFIC CRITERIA:	AE1 knowledge covering aeronautical or astronautical engineering areas AE2 knowledge of some topics from area not emphasized
POLICIES:	• Students must attend classes and labs. • Lab reports will be due one week after the completion of the Lab. Late reports will only be accepted upon instructor's agreement. • Quizzes and exam are open book, quizzes may not be announced.
AUTHOR/DATE:	Fangjun Shu October 2017

Engineering Physics Program

(Bachelor of Science in Engineering Physics)

at

New Mexico State University

Syllabi of Chemical Engineering Courses

CHME 101. Introduction to Chemical Engineering Calculations

Course number and name: CHME 101. Introduction to Chemical Engineering Calculations

Credits and contact hours: 2 credit hours = 30 contact hours per semester

Instructor's or course coordinator's name: David A. Rockstraw

Text book, title, author, and year

- Elementary Principles of Chemical Processes, 4th Edition by Richard M. Felder, Ronald W. Rousseau, Lisa G. Bullard; Wiley, July 2015, ©2016
- MATLAB Numerical Methods with Chemical Engineering Applications, by: Kamal I. M. Al-Malah, Ph.D.; McGraw-Hill Education, 2014 (free online in the eLibrary at AICHE.org for AICHE members).

a. other *supplemental materials*: hand-outs

Specific course information

a. ***catalog description:*** Introduction to the discipline of chemical engineering, including: an overview of the curriculum; career opportunities; units and conversions; process variables; basic data treatments; and computing techniques including computer programming and use of spreadsheets.

b. prerequisites: none co-requisites: MATH 190

c. this is a required course for Engineering Physics majors with the Chemical Concentration

Specific goals for the course

a. The student will: • understand the diverse career opportunities available to one holding a BSCHE from NMSU; • be aware of the flow of content and prerequisite requirements across the BSCHE; • be capable of rapidly performing conversion of chemical engineering units both by hand and using computer software, specifically including (1) converting between mixture mass and mole fractions, and (2) explaining the difference and converting between absolute and relative pressure and temperature scales; • applying the concept of significant figures; • be able to perform a regression of data to a mathematical model; • numerically solve systems of linear algebraic equations by multiple methods; • be capable of validating calculated results; • be functional in the graphic user interface of Matlab, Mathcad, and Excel; • be capable of generating two-dimensional plots of data and functions in Matlab, Mathcad, and Excel; • implement logical IF statements writing Matlab code and using builtin functions of an Excel spreadsheet; • implement flow-of-control operations in Matlab, correctly applying WHILE and FOR statements; and • implement input/output data treatments in Matlab.

b. The Program Outcomes addressed by this course can be found in Table 3.1.c in Criterion 3 of this Self-Study Report.

Brief list of topics to be covered

1. Career opportunities in Chemical Engineering
2. Units and conversions
3. process variables
4. data regression
5. numerical calculations

CHME 102. Material Balances

Course number and name: CHME 102. Material Balances

Credits and contact hours: 3 credit hours = 45 contact hours per semester

Instructor's or course coordinator's name: Martha Mitchell

Text book, title, author, and year

- Elementary Principles of Chemical Processes, 4th edition, 2016. Felder, Rousseau and Bullard. Wiley and Sons. Loose-leaf (binder-ready) ISBN: 978-1-118-43122-1 E-text: ISBN: 978-1-119-19023-3
- Essential PTC MathCAD Prime 3.0 1st edition, 2013, Maxfield, Brent, Elsevier. ISBN: 978-0-12410410-5
  a. other *supplemental materials* none

Specific course information

a. ***catalog description:*** Chemical Engineering basic problem-solving skills; unit conversions; elementary stoichiometry; material balances; sources of data.
b. prerequisites: MATH 190G, CHME 101 co-requisites: CHEM 111/115
c. this is a required course for Engineering Physics majors with the Chemical Concentration

Specific goals for the course

a. The student will be able to: • Describe careers that some chemical engineers pursue, and to describe to a high school student what a chemical engineer does; • Use modern engineering tools (MathCAD®, and Excel) to solve basic engineering and math problems that are part of material balance calculations (plotting, use of arrays and matrices, simple programming operations, formulas); • Generate two-dimensional plots, perform linear regression and solve systems of linear algebraic equations; • Correctly implement engineering calculations: unit conversions; units of mass and weight, significant figures; • Understand the importance of validating results; • Convert between mass and mole fractions in a mixture; • Explain the difference and convert between absolute and relative pressure and temperature scales; • Draw and label a correct diagram (flowchart) given a problem statement; • Choose a basis of calculation; • Correctly perform a degree of freedom analysis; • Analyze and solve elementary material balances on single and multi-unit process, for both nonreactive and reactive processes; • Solve material balance calculations with: recycle, purge, fractional conversion of the limiting reactant, percentage excess of a reactant, yield and selectivity, dry-basis composition, theoretical air and percent excess air; • Use equations of state for single-phase property calculations; • Use "standard" volumes for gases; • Calculate vapor pressures; • Use Raoult's and Henry's law; • Sketch a phase diagram; and • Calculate bubble points and dew points for ideal solutions.
b. The Program Outcomes addressed by this course can be found in Table 3.1.c in Criterion 3 of this Self-Study Report.

Brief list of topics to be covered

1. Ch.1 - What Some Chemical Engineers Do for A Living
2. Ch. 2 - Introduction to Engineering Calculations

3. Ch. 3 - Excel basics: cells, arrays, plotting, using a spreadsheet • MathCAD® basics: unit conversions, plotting, problem solving • MATLAB® basics: problem solving, arrays, matrices • Process and process variables
4. Ch. 4 Fundamentals of Material Balances
5. Ch. 5 Single-Phase Systems
6. Ch. 6 Multiphase Systems

CHME 201. Energy Balances

Course number and name: CHME 201. Energy Balances & Basic Thermodynamics

Credits and contact hours: 3 credit hours = 45 contact hours per semester

Instructor's or course coordinator's name: Umakanta Jena

Text book, title, author, and year

- Elementary Principles of Chemical Processes, 4th edition, 2016. Felder, Rousseau and Bullard. Wiley and Sons. Loose-leaf (binder-ready) ISBN: 978-1-118-43122-1 E-text: ISBN: 978-1-11919023-3

a. other *supplemental materials*: none

Specific course information

a. ***catalog description:*** Chemical Engineering energy balances; combined energy and material balances including those with chemical reaction, purge and recycle; thermochemistry; application to unit operations; introduction to the first law of thermodynamics and its applications.
b. prerequisites: CHME 102, CHEM 115 or CHEM 111G, and MATH 192G co-requisites: none
c. this is a required course for Engineering Physics majors with the Chemical Concentration

Specific goals for the course

a. The student will be able to…

- Determine individual learning style and describe how learners of that style can help themselves , • Use modern engineering tools (example, Excel) to solve material and energy balance problems, • Understand how professional and ethical responsibility corresponds to the NMSU Student Code of Conduct; • Correctly implement unit conversions (outcome (a) an ability to apply knowledge of mathematics, science, and engineering), • Analyze and solve elementary material balances on single and multi-unit process, for both nonreactive and reactive processes, • Apply the first law of thermodynamics to batch and flow processes, • Locate thermophysical property data in the literature and estimate properties when data are not available, • Conduct combined material and energy balances around continuous multi-unit processes with and without chemical reaction, • Perform process calculations using psychrometric charts, enthalpy concentration diagrams and steam tables, • Derive and solve differential equations for transient heat and material balances on dynamic systems. • Determine individual learning style and describe how learners of that style can help themselves, • Use modern engineering tools (example, Excel) to solve material and energy balance problems, • Understand how professional and ethical responsibility corresponds to the NMSU Student Code of Conduct; • Correctly implement unit conversions, • Analyze and solve elementary material balances on single and multi-unit process, for both nonreactive and reactive processes, • Apply the first law of thermodynamics to batch and flow processes, • Locate thermophysical property data in the literature and estimate properties when data are not available; • Conduct combined material and energy balances around continuous multi-unit processes with and without chemical reaction, • Perform process calculations using psychrometric charts, enthalpy concentration diagrams and steam tables, • Derive and solve differential equations for transient heat and material balances on dynamic systems.

b. The Program Outcomes addressed by this course can be found in Table 3.1.c in Criterion 3 of this Self-Study Report.

7. **Brief list of topics to be covered**

1. Introduction to engineering calculations
2. Process variables
3. Material balances
4. Excel basics: cells, arrays, plotting, using a spreadsheet
5. Energy and energy balances
6. Material and energy balances on nonreactive processes
7. Material and energy balances on reactive processes
8. Transient balances

CHME 303. Chemical Engineering Thermodynamics

Course number and name: CHME 303. Chemical Engineering Thermodynamics

Credits and contact hours: 4 credit hours = 60 contact hours per semester

Instructor's or course coordinator's name: Hongmei Luo

Text book, title, author, and year

- Fundamentals of Chemical Engineering Thermodynamics, Dahm, K.D. & Visco, D.P., 1st edition, Cengage Learning, 2015, ISBN 1-111-58070-7.
- Sandler, Stanley I., Chemical, Biochemical, and Engineering Thermodynamics, 4th edition, John Wiley and Sons, 1999, ISBN# 0-471-66174-0.

a. other *supplemental materials*: none

Specific course information

a. ***catalog description:*** Applications of the First Law and Second Law to chemical process systems, especially phase and chemical equilibria and the behavior of real fluids. Development of fundamental thermodynamic property relations and complete energy and entropy balances. Modeling of physical properties for use in energy and entropy balances, heat and mass transfer, separations, reactor design, and process control.
b. prerequisites: CHME 201, MATH 291; co-requisites: MATH 392
c. this is a required course for Engineering Physics majors with the Chemical Concentration

Specific goals for the course

a. student goals: • Enhance students' ability to perform material and energy balances. • Develop students' understanding of energy transformation limitations. • Enable students to better use, predict, and produce thermodynamic data. • Enable students to characterize and predict phase behavior. • Develop students' quantitative understanding of chemical reaction equilibrium. • Enhance students' ability to identify, formulate and solve engineering problems. • Develop students' design skills for engineering unit operations using thermodynamic principles, and including consideration of safety and environmental concerns. • Develop student's skills in the use of modern engineering tools. • Provide an opportunity for students to work effectively as a member of team.
b. The Program Outcomes addressed by this course can be found in Table 3.1.c in Criterion 3 of this Self-Study Report.

Brief list of topics to be covered

1. Use an engineering problem-solving strategy
2. Define system boundaries.
3. Calculate the heat energy requirement for a chemical or physical process.
4. Solve problems using an appropriate energy balance.
5. Calculate the work requirement for a chemical or physical process. • Solve problems using the appropriate entropy balance.
6. Formulate and use ordinary and partial differential equations to solve thermodynamics problems.
7. Determine equilibrium conditions for chemical species transfer between phases.

8. Estimate property values for a chemical species at a given state.
9. Communicate thermodynamic concepts in the context of phase change and energy conversion processes, such as refrigeration, engines, and electricity production.
10. Use departure functions to solve the First and the Second Law problems for non-ideal systems

CHME 305. Transport Operations I: Fluid Flow

Course number and name: CHME 305. Transport Operations I: Fluid Flow

Credits and contact hours: 3 credit hours = 45 contact hours per semester

Instructor's or course coordinator's name: Reza Foudazi

Text book, title, author, and year

- Fluid Mechanics Fundamentals and Applications, 4th Edition Authors: by Yunus A. Cengel, John M. Cimbala Publisher: McGraw-Hill, 2018

a. other *supplemental materials* none

Specific course information

a. ***catalog description:*** Theory of momentum transport. Unified treatment via equations of change. Shell balance solution to 1-D problems in viscous flow. Analysis of chemical engineering unit operations involving fluid flow. General design and operation of fluid flow equipment and piping networks.
b. prerequisites: CHME 201, MATH 291 co-requisites: MATH 392
c. this is a required course for Engineering Physics majors with the Chemical Concentration

Specific goals for the course

a. The student will be able to : • solve applied math problems involving linear ordinary differential equations with boundary conditions; • solve partial differential equations that can be analytically solved with boundary condition; • identify how coordinate systems are used with ODEs and PDEs; • simplify second order PDEs with assumptions; • identify when an analytical solution to a PDE is possible and when numerical methods are required; • identify the properties of fluids; • calculate problems that involve pressure measurements; • solve fluid statics problems using the basic equation of fluid statics; • apply principles of fluid kinematics to differentiation among vector fields; • describe physical phenomena of fluid flow; • define and explain viscosity, density, and specific gravity; • calculate surface forces on static fluids; • differentiate between Newtonian and Non-Newtonian fluids; • identify laminar flow and turbulent flow; • calculate the Reynold's number and it in fluid flow problems; • apply the Bernoulli equation to sets of fluid problems; • solve energy balances in the context of fluids and fluid motion; • distinguish between approximations of and appropriate models for Bernoulli's Equation (i.e friction losses, pumps, compressors, turbines, surface forces, gas-liquid flow, non-Newtonian fluids, and the Moody diagram); • apply momentum balances using the governing equations of momentum to solve one dimensional velocity profile problems of external or internal viscous fluid flow; • interpret the different approximations of the momentum balance; • classify differential vs. integral forms of momentum analysis; • calculate problems using the Navier Stoke's Equations.identify different turbo- and fluidmachinery; • explain why computational fluid dynamics is important; • solve problems using external flow with applications: boundary layers, lift, drag; and • calculate problems with dimensional analysis methods.
b. The Program Outcomes addressed by this course can be found in Table 3.1.c in Criterion 3 of this Self-Study Report.

Brief list of topics to be covered

1. viscosity and fluid definitions
2. fluid statics
3. Bernoulli equation
4. fluid kinematics
5. velocity fields
6. Reynolds Transport Theorem
7. finite control volume analysis
8. differential analysis of fluid flow
9. dimensional analysis
10. viscous flow in pipes
11. flow over immersed bodies
12. turbomachinery

CHME 306. Transport Operations II: Heat and Mass Transfer

Course number and name: CHME 306. Transport Operations II: Heat and Mass Transfer

Credits and contact hours: 4 credit hours = 60 contact hours per semester

Instructor's or course coordinator's name: Catherine Brewer

Text book, title, author, and year

- Fundamentals of Heat and Mass Transfer, 7/E by Bergman, Lavine, Incropera, and Dewitt. ISBN 9780470501979; Wiley (2011)

a. other *supplemental materials* none

Specific course information

a. ***catalog description:*** Theory of heat and mass transport. Unified treatment via equations of change. Analogies between heat and mass transfer. Shell balance solution to 1-D problems in heat and mass transfer. Analysis of chemical engineering unit operations involving heat transfer. Design principles for mass transfer equipment. 4 credits. Restricted to majors.
b. prerequisites: CHME 305 and MATH 392 co-requisites: CHME 392
c. this is a required course for Engineering Physics majors with the Chemical Concentration

Specific goals for the course

a. The student will: Adopt a systematic problem solving approach, consistently and effectively. • Diagram heat flows for conductive, convective, and radiative processes. • Find and use material property values. • Convert and use appropriate units of energy, power, flux, etc. • Write conservation equations for planar, cylindrical and spherical systems. • Apply assumptions such as steady state, number of dimensions, order of magnitude, and/or constant properties to simplify conservation equations. • Solve the energy conservation equation for the temperature distribution using appropriate boundary and/or initial conditions. • Calculate heat fluxes into and out of a control volume. • Draw resistance circuits and calculate the overall heat transfer coefficient, U, for compound systems. • Calculate the temperature distribution, heat flux, efficiency, and effectiveness of extended surfaces such as fins. • Use lumped capacitance and exact solution models to solve transient heat transfer problems. • Calculate transport dimensionless numbers and explain what they represent. • Use fluid velocity profiles to calculate boundary layer shapes and thicknesses. • Calculate convection heat transfer coefficient, h, for external and internal flows using formulas and graphs of experimental results. • Explain the causes and relative magnitudes of free convection. • Calculate free convection coefficients using equations and experimental results. • Label key regimes and heat transfer features of boiling and condensation curves. • Compare and contrast parallel, cross, and countercurrent flow in heat exchangers. • Determine the needed surface areas and/or fluid flow rates for heat exchangers given unit operation or process energy needs. • Calculate and explain heat exchanger efficiency. • Predict likelihood and account for consequences of fouling. • Define radiation terminology such as blackbody, grey surface, emissivity, etc. • Relate surface temperature to radiation wavelength and energy. • Calculate the view factor between two surfaces and use it to calculate heat transfer. • Write and solve the mass and molar forms of the 1-D mass conservation equations. • Calculate absolute and relative species velocities and fluxes. • Use heat transfer relationships and analogous equations to solve diffusion and advection mass transfer problems. • Predict which kind(s) of heat transfer will be relevant for a given situation. • Describe implications of problem solutions and perform additional “what if” calculations to understand patterns in the “bigger picture”.

b. The Program Outcomes addressed by this course can be found in Table 3.1.c in Criterion 3 of this Self-Study Report.

Brief list of topics to be covered

1. modes of heat transfer
2. steady state, 1-D conduction
3. 2-D conduction
4. transient conduction
5. extended surfaces
6. boundary layers
7. forced convection
8. natural convection
9. convection with phase change
10. heat exchangers
11. radiation science
12. radiation exchange
13. 1-D mass diffusion
14. mass fractions and concentrations

CHME 307. Transport Operations III: Staged Operations

Course number and name: CHME 307. Transport Operations III: Staged Operations

Credits and contact hours: 3 credit hours = 45 contact hours per semester

Instructor's or course coordinator's name: Thomas Manz

Text book, title, author, and year

- Wankat, Phillip C., Separation Process Engineering (Includes Mass Transfer Analysis), 4th edition, Prentice Hall, 2012, ISBN# 0-13-344365-5.

a. other *supplemental materials* none

Specific course information

a. ***catalog description:*** Theory of mass transport. Mass transfer coefficients. Analysis of chemical engineering unit operations involving mass transfer and separations. Equilibrium stage concept. General design and operation of mass-transfer equipment and separation sequences.
b. prerequisites: CHME 302, CHME 306 co-requisites: none
c. this is a required course for Engineering Physics majors with the Chemical Concentration

Specific goals for the course

a. The student will: • Determine which kind of separation (e.g., distillation, adsorption, membrane, etc.) is best suited to separate a particular mixture • Design various kinds of separation units to achieve a target flow rate and purity • Evaluate the cost effectiveness and energy requirements of a separation • Perform McCabe-Theile analysis • Include efficiencies and mass transfer effects in the design of separation units
b. The Program Outcomes addressed by this course can be found in Table 3.1.c in Criterion 3 of this Self-Study Report.

Brief list of topics to be covered

1. Single equilibrium stages and flash drum calculations
2. Continuous and batch distillation columns
3. Packed and staged distillation columns
4. McCabe-Thiele analysis
5. Absorption and stripping
6. Extractive separation
7. Membrane processes
8. Adsorption processes

CHME 352L. Simulation of Unit Operations

Course number and name: CHME 352L. Simulation of Unit Operations

Credits and contact hours: 1 credit hours = 15 contact hours per semester

Instructor's or course coordinator's name: John W. Schutte (under direction of David A. Rockstraw)

Text book, title, author, and year

- Aspen Plus® Chemical Engineering Applications by Kamal I.M. Al-Malah, 2017.

a. other *supplemental materials* This course will use content from the texts required of the pre- and co-requisite courses, as well as texts from numerous foundation courses of the curriculum.

Specific course information

a. ***catalog description:*** Definition, specification, and convergence of basic unit operations in a process simulator. Course will cover pipe networks, pressure changers, heat exchangers, distillation columns, and chemical reactors.
b. prerequisites: none co-requisites: CHME 307, CHME 441
c. this is a required course for Engineering Physics majors with the Chemical Concentration

Specific goals for the course

a. The student will be able to: • specify and converge unit operations in Aspen Plus®; • perform a physical property analysis; • apply non-rigorous balance units, and know how and when to do so; • specify and converge pressure changer unit operations; • specify and converge pipes and pipe networks (mechanical energy balance); • specify and converge heat exchangers; • specify and converge reactors and understand when to use stoichiometric vs. kinetic models; • specify and converge flash drums and decanters; and • understand the basics of performing distillation column analysis.
b. The Program Outcomes addressed by this course can be found in Table 3.1.c in Criterion 3 of this Self-Study Report.

Brief list of topics to be covered

1. convergence
2. Physical property analysis
3. Non-rigorous balance units
4. Pressure changers
5. Pipes and pipe networks (mechanical energy balance)
6. Heat exchangers
7. Reactors and kinetic models
8. Flash drums and decanters
9. Basics of distillation column analysis

CHME 361. Engineering Materials

Course number and name: CHME 361. Engineering Material

Credits and contact hours: 3 credit hours = 45 contact hours per semester

Instructor's or course coordinator's name: Paul K. Andersen

Text book, title, author, and year

- Michael F. Ashby and David R. H. Jones (2012), Engineering Materials 1: An Introduction to Properties, Applications, and Design, Fourth Edition. (Oxford: Elsevier.)

a. other *supplemental materials* P. K. Andersen (2017) Study Guide for Engineering Materials 1. (Available on the course Canvas site)

Specific course information

a. ***catalog description:*** Bonding and crystal structure of simple materials. Electrical and mechanical properties of materials. Phase diagrams and heat treatment. Corrosion and environmental effects. Application of concepts to metal alloys, ceramics, polymers, and composites. Selection of materials for engineering design.
b. prerequisites: CHEM 111G or CHEM 114 or CHEM 115; MATH 190G co-requisites: none
c. this is a required course for Engineering Physics majors with the Chemical Concentration

Specific goals for the course

a. The student will be able to: • Explain the relationships between composition, bonding, structure, and properties. • Explain the effects of supply and demand on materials prices. • Compute stress and strain and identify important mechanical properties. • Explain the effects of defects on material properties. • Explain the common modes of materials failure. • Predict rates of materials failures. • Select materials to avoid failure. • Explain the origins of electrical and magnetic properties. • Discuss contemporary issues in materials science and engineering.
b. The Program Outcomes addressed by this course can be found in Table 3.1.c in Criterion 3 of this Self-Study Report.

Brief list of topics to be covered

1. Materials and Properties
2. Price and Availability
3. Bonding and Structure
4. Stress and Strain
5. Yielding and Ductility
6. Fracture and Toughness
7. Fatigue
8. Creep Deformation and Fracture
9. Oxidation and Corrosion
10. Friction and Wear
11. Electric and Magnetic Properties

CHME 441.Chemical Kinetics and Reactor Engineering

Course number and name: CHME 441. Chemical Kinetics and Reactor Engineering

Credits and contact hours: 3 credit hours = 45 contact hours per semester

Instructor's or course coordinator's name: David A. Rockstraw

Text book, title, author, and year

- Elements of Chemical Reaction Engineering, 5/E by H. Scott Fogler ISBN-13: 978-0133887518 ISBN-10: 0133887510; Prentice Hall (2016)

Specific course information

a. ***catalog description:*** Analysis and interpretation of kinetic data and catalytic phenomena. Applied reaction kinetics; ideal reactor modeling; non-ideal flow models. Mass transfer accompanied by chemical reaction. Application of basic engineering principles to design, operation, and analysis of industrial reactors.

b. prerequisites: CHEM 313, CHME 302 and CHME 306 co-requisites: CHME 307

c. this is a required course for Engineering Physics majors with the Chemical Concentration

Specific goals for the course

a. The student will be able to: define the rate of chemical reaction, conversion, and space time; • write mole balances in terms of conversion for a batch reactor, CSTR, PFR, and PBR; • determine reactor sizes (volume, catalyst weight) for reactors either alone or in series once given the molar flow rate of A and the rate of reaction, – rA, as a function of conversion, X; • write the relationship between the relative rates of reaction; • write a rate law and define reaction order and activation energy; • define the Arrhenius Equation and describe how rate of reaction varies with temperature; • describe homogeneous, heterogeneous, elementary, nonelementary and reversible reactions; • express species concentration as a function of conversion for liquid and gas phase reactions; • express the volumetric flow rate for a gas phase reaction as a function of conversion; • express the rate of reaction as a function of conversion for any given rate law; • account for effect of pressure drop on conversion in packed bed reactors; • size batch reactors, semibatch reactors, CSTRs, PFRs, PBRs, membrane reactors, and microreactors for isothermal operation given the rate law and feed conditions; • determine the reaction order and specific reaction rate from experimental data; • describe how the methods of half lives, and of initial rate, are used to analyze rate data; • choose the appropriate reactor and reaction system that would maximize the selectivity of the desired product given the rate laws for all the reactions occurring in the system; • size reactors to maximize selectivity and to determine the species concentrations in a batch reactor, a semibatch reactor, a CSTR, a PFR, and a PBR, in systems with multiple reactions; • discuss pseudo-steady-state-hypothesis and how it is used; • explain what an enzyme is and how it acts as a catalyst; • describe Michaelis-Menten enzyme kinetics and rate law with its temperature dependence; • discuss how to distinguish the different types of enzyme inhibition; • discuss the stages of cell growth and the rate laws used to describe growth; • write material balances on cells, substrates, and products in bioreactors to size chemostats and plot concentration-time trajectories in batch reactors; • define a catalyst, a catalytic mechanism and a rate limit step; • describe the steps in a catalytic mechanism and how one goes about deriving a rate law and a mechanism and rate limiting step consistent with the experimental data; • size isothermal reactors for reactions with Langmuir-Hinshelwood kinetics; • discuss the different types of catalyst deactivation and the reactor types and describe schemes that can help offset the deactivation; • describe the steps in Chemical Vapor Deposition(CVD); • size adiabatic CSTRs, PFRs, and PBRs; • use reactor staging to obtain high conversions for highly exothermic reversible reactions; • size nonadiabatic CSTRs, PFRs, and PBRs; • carry out an analysis to determine the Multiple Steady States (MSS) in a CSTR along with the ignition and extinction temperatures; • analyze multiple reactions carried out in CSTRs, PFRs, and PBRs which are not operated isothermally in order to determine the concentrations and temperature as a function of position (PFR/PBR) and operating variables; • analyze batch reactors and semibatch not operated isothermally; • analyze perturbations in temperature and presence for CSTRs being operated at steady state and describe under what conditions the reactors can be unsafe (safety); • analyze multiple reactions in batch and semibatch reactors not operated isothermally; • define a residence time distribution (RTD) [E(t), F(t)] and the mean residence time; • determine E(t) form tracer data; • write the RTD functions (E(t), F(t), I(t)) for ideal CSTRs, PFRs, and laminar flow reactors; • describe the tanks-in-series and dispersion one parameter models; • describe how to obtain the mean residence time and variance to calculate the number of tanksin-series and the Peclet number; • calculate Peclet numbers and dispersion coefficients using correlations and RTD data; and • calculate conversion for a first order reaction in a tubular reactor with dispersion.

b. The Program Outcomes addressed by this course can be found in Table 3.1.c in Criterion 3 of this Self-Study Report.

Brief list of topics to be covered

1. mole balances
2. conversion
3. reactor sizing
4. rate laws
5. reacting system stoichiometry
6. isothermal reactor design
7. collection and analysis of rate data
8. systems involving multiple reactions
9. non-ideal reaction mechanisms
10. bioreactions and bioreactors
11. steady-state nonisothermal reactor design
12. unsteady state nonisothermal reactor design
13. catalysis and catalytic reactors
14. distributions of residence times for chemical reactors
15. models for nonideal reactors

Electrical Engineering Courses

Engineering Physics Program

(Bachelor of Science in Engineering Physics)

at

New Mexico State University

Syllabi of Electrical Engineering Courses

Equivalent Electrical Engineering Courses between New and Old Curricula

New Curriculum (2016+ Catalog) ***Course and Title***	*Old Curriculum (Prior to 2016 Catalog)* ***Course and Title***
E E 100 Introduction to Electrical & Computer Engin.	E E 162 Digital Circuit Design
E E 112 Embedded Systems	E E 161 Computer Aided Prob. Solving
E E 200 Linear Algebra, Probability, Statistics Apps	E E 210 Engineering Analysis I
E E 212 Intro to Computer Archit. & Organization	E E 363 Computer Systems Architecture I
E E 230 AC Circuit Analysis & Intro to Power Sys.	E E 280 DC & AC Circuits E E 391 Intro to Electric Power Engineering
E E 240 Multivariate and Vector Calculus Apps	E E 310 Engineering Analysis II
E E 300 Cornerstone Design	E E 418 Capstone Design I
E E 317 Semiconductor Devices and Electronics	E E 380 Electronics I
E E 320 Signals & Systems I	E E 312 Signals & Systems I
E E 325 Signals & Systems II	E E 314 Signals & Systems II
E E 340 Fields and Waves	E E 351 App. Electromagnetics
E E 402 Capstone Design	E E 419 Capstone Design II

EE 100 - Introduction to Electrical and Computer Engineering

Course Number and Name: EE 100 Introduction to Electrical and Computer Eng.
Credits: 4 credits
Instructor: Paul M. Furth
Text Book, Title, Author and Year: *Principles of Electric Circuits – Conventional Current, 9th Ed.,* Thomas L. Floyd (2010) and *Digital Fundamentals*, 11th Ed., Thomas L. Floyd (2015).
Other Supplemental Materials: None
Catalog Description: Introduction to analog (DC) circuits and digital logic, including electric component descriptions and equations, Ohm's law, Kirchhoff's voltage and current laws, ideal op-amp circuits, Boolean algebra, design of combinational and sequential logic circuits and VHDL.
Prerequisites: None, **and Corequisites:** MATH 190G
Core, Specialization, Elective: *Course is required for Engineering Physics students with the Electrical Concentration*
Course Goal: Introduce students to the field of electrical and computer engineering through applying skills in basic circuits and digital logic.
Course Outcomes: At the end of EE 100, students will:

a. Analyze and design DC circuits, including ideal op-amps, using concepts of voltage, current, power, Kirchoff's laws, and network theorems.
b. Analyze and design combinatorial and sequential logic circuits and state machines and implement designs in VHDL
c. Design simple systems involving dc circuits, op-amps and FPGA for a specified function or purpose.
d. Work and learn effectively in teams.

Mapping to Departmental Student Outcomes:

ECE Outcome	EE 100 Course Outcome
Ability to apply mathematics, science and engineering principles.	**a, b**
Ability to design a system, component, or process to meet desired needs.	**c**
Ability to function on multidisciplinary teams.	**d**

Topics list

a. Quantities and Units
b. Voltage, Current, Resistance and Ohm's Law
c. Energy and Power
d. Series Circuits, Parallel Circuits, and Series/Parallel Circuits
e. Thevenin's Theorem
f. Node-Voltage Method

g. Ideal Op-amps
h. Number Systems, Operations and Codes
i. Logic Gates, VHDL
j. Boolean Algebra, DeMorgan's Theorem, and Logic Simplification
k. Function of Combinational Logics, e.g., adders, decoders, multiplexors
l. Latches, Flip-flops and Registers
m. Finite-State Machines and Counters
n. Laboratory topics include: (1) the operation of laboratory instruments, including, the digital multi-meter, function generator, and oscilloscope, (2) proto-typing and testing circuits on breadboards, (3) using other circuit elements, including LEDs and sensors, (4) IC opamp circuits, (5) FPGA programming using VHDL, (7) FPGA interfacing to peripheral devices, including switches, 7-segment displays, and sensors through GPIO.

EE 112 - Embedded Systems

Course Number and Name: EE 112 Embedded Systems
Credits: 4 credits
Instructor: Paul M. Furth
Text Book, Title, Author and Year: *Problem Solving and Program Design in C, 7th Ed.*, Jeri R. Hanly and Elliot B. Koffman (2012).
Other Supplemental Materials: None
Catalog Description: Introduction to programming through microcontroller-based projects. Extensive practice in writing computer programs to solve engineering problems with microcontrollers, sensors, and other peripheral devices.
Prerequisites: EE 100, **and Corequisites:** MATH 190G
Core, Specialization, Elective: *Course is required for Engineering Physics students with the Electrical Concentration*
Course Goal: Introduce students to computer programming on a micro-controller that interfaces with sensors, and other peripheral devices.
Course Outcomes: At the end of EE 100, students will:

a. Analyze a problem statement, design an algorithm to solve the problem, and implement the algorithm with a computer program.
b. Use basic components of a computer program including control statements, data structures, functions, and loops
c. Program a microcontroller to access and control a variety of sensing and other peripheral devices
d. Work and learn effectively in teams.

Mapping to Departmental Student Outcomes:

ECE Outcome	EE 112 Course Outcome
Ability to apply mathematics, science and engineering principles.	**b**
Ability to design a system, component, or process to meet desired needs.	**c**
Ability to function on multidisciplinary teams.	**d**
Ability to identify, formulate and solve engineering problems.	**a**

Topics list

a. Introduction to the Computer and Software Development Method
b. C Language Elements
c. Variables, Assignments, Inputting and Outputting Data
d. Arithmetic Expressions and Math Library Functions
e. Functions with Input Arguments

f. Conditions, If and Compound If Statements
g. Switch Statement
h. While Loops, For Loops, Do-While Loops
i. Conditional Loops, Counting Loops, Loop Design
j. Nested Loops
k. Pointers and Functions with Output Arguments
l. Declaring and Referencing Array Elements
m. Functions with Array Input or Output Arguments
n. Searching and Sorting Arrays
o. Parallel Arrays and Array Processing
p. Introduction to Strings
q. Arduino and Atmel Microcontroller Organization
r. Laboratory topics include: (1) Arduino programming environment, (2) interfacing with potentiometer, speaker, LEDs, temperature sensor, light sensor, pushbutton switches, and rotary encoder, (3) ADC sampling rate, (4) hardware interrupts, and (5) a student-selected hardware/software project.

EE 200 - Linear Algebra and Probability

Course Number and Name: EE200 Linear Algebra and Probability
Credits: 4 credits
Instructor: Charles Creusere
Text Book, Title, Author and Year: E. Kreyszig, *Linear Alg & Probability NM State*, John Wiley & Sons, Inc., 2012, ISBN: 9781119240945. This custom text contains Chapters 7, 8, 20, 24, 25, and Appendix 2 from E. Kreyzig, *Advanced Engineering Mathematics*, 10^{th} edition, John Wiley & Sons, Inc., 2011, ISBN: 9780470458365.
Other Supplemental Materials: Matlab; Chapter 10, Goodman & Yates
Catalog Description: The theory of linear algebra (vectors and matrices) and probability (random variables and random processes) with application to electrical engineering. Computer programming to solve problems in linear algebra and probability.
Prerequisites: Math 192 and EE112. **Corequisites:** none.
Core, Specialization, Elective: *Course is required for Engineering Physics students with the Electrical Concentration*
Course Goal: Provide students with basic math background in probability theory and linear algebra and to demonstate the utility of such mathematical concepts in solving engineering problems. Students learn and apply Matlab to solve problems and master concepts.
Course Outcomes: At the end of EE 200, student will:

a. Perform vector and matrix operations, including matrix inversion, eigen analysis, finding basis and dimension of vector spaces and rank of a matrix, and solving a set of linear equations.
b. Calculate probabilities using probability mass, density, and cumulative distribution functions for single and multiple, discrete and continuous random variables, and relate them to electrical engineering applications.
c. Perform simple parameter estimation, such as finding sample mean and variance, and relate to confidence intervals.
d. Describe random processes in the context of signal processing and communications systems problems.
e. Use MATLAB to solve problems involving linear algebra and probability, including designing and performing simple numerical experiments.

Mapping to Departmental Student Outcomes:

ECE Outcome	EE 200 Course Outcome
Ability to apply mathematics, science and engineering principles.	**a, b**
Ability to design and conduct experiments, analyze and interpret data.	**C**
Ability to identify, formulate and solve engineering problems.	**d**

Ability to use the techniques, skills and modern engineering tools necessary for engineering practice.	**e**

Topics list

a. Experiments, Outcomes, and Events
b. Probability
c. Random Variables--Distributions
d. Mean, Variance, Moments
e. Important Distributions: Normal, etc.
f. Multivariate Distributions
g. Random Processes
h. Statistics: Sample Mean/Variance, Confidence Intervals
i. Matrix/Vector Equations
j. Systems of Linear Equations: Gauss Elimination
k. Matrix Ranks and Vector Spaces
l. Determinants
m. Matrix Inverses: Gauss-Jordan Elimination
n. Eigenvalue Problems

EE 212 - Computer Organization and Design

Course Number and Name: EE212 Computer Organization and Design
Credits: 4 credits (3+3P)
Instructor: Abdel-Hameed Badawy
Text Book, Title, Author and Year: *Computer Organization and Design: The Hardware/Software Interface*, 5th edition, MIPS edition, David A. Patterson and John L. Hennessy (2014)
Other Supplemental Materials: Quartus II – FPGA programming software
Catalog Description: Concepts of modern computer architecture. Processor micro-architectures, hardwired vs. micro-programmed control, pipelining and pipeline hazards, memory hierarchies, bus-based system architecture, memory mapping, hardware-software interface, and operating system concepts. Comparison of architectures to illustrate concepts of computer organization; relationships between architectural and software features.
Prerequisites and Co-requisites: CS 273 (Machine Programming and Organization) or EE 260 (Embedded Systems) or EE 100 (Circuits and Digital Design) and EE 112 (Embedded Systems Programming)
Core, Specialization, Elective: *Course is required for Engineering Physics students with the Electrical Concentration*
Course Goal: Provide students with an overview of the various aspects of computer system organization and CPU architecture.
Course Outcomes: At the end of EE 212, student will:

a. Understand the micro components of a computer system, including memory, cache, registers, ALU's, pipelines, instruction decoding.
b. Understand the operation of a processor, including the fetch/execute cycle, memory access, virtual memory, addressing modes, data types, and instruction sets.
c. Understand the relationship between hardware and software.
d. Understand their professional and ethical responsibilities with respect to computer architectural design decisions.
e. Understand the potential global, economic, environmental, and societal impact of their engineering decisions.
f. Demonstrate an awareness of current topics in computer architecture

Mapping to Departmental Student Outcomes

ECE Outcome	EE 212 Course Outcome
Understanding of professional and ethical responsibility.	**e**
The broad education necessary to understand the impact of engineering solutions in a global and societal context.	**f**
Knowledge of contemporary issues.	**g**

Topics list

a. Hardware architecture
b. Data types
c. Assembly programming
d. Pipelining
e. Cache
f. Virtual memory
g. Multi-processing
h. Cache coherence & Consistency models
i. Hardware security

EE 230 - AC Circuits and Introduction to Power

Course Number and Name: EE230 AC Circuits and Introduction to Power
Credits: 4 credits
Instructor: Sang-Yeon Cho
Text Book, Title, Author and Year: *Electric Circuits*, 10th Ed., James Nilsson and Susan Riedel, Pearson, 2015
Other Supplemental Materials: Lab kits
Catalog Description: Electric component descriptions and equations; complete solutions of RLC circuits; steady-state analysis of AC circuits; introduction to power systems in the steady-state.
Prerequisites: EE 100, PHYS 215G and MATH 192G. **Corequisites:** none.
Core, Specialization, Elective: *Course is required for Engineering Physics students with the Electrical Concentration*
Course Goal: EE230 provides students with an understanding of the basic methods that are used for the time and frequency domain analysis of AC electric circuits and power systems.
Course Outcomes: Students completing the course with a grade of C or better will be able:

a. To develop competency in the application, analysis and design of RL, RC, and RLC circuits (sinusoidal steady state), Phasor analysis, power concepts in ac circuits; and have initial exposure to frequency response concepts.
b. To develop competency in the basic structure, analysis methods, and properties of balance, three-phase ac power systems.
c. To apply the basic tools and circuit elements used in electrical engineering, the proper and responsible use of oscilloscopes, digital multi-meters, power supplies, function generators, and other electronic testing equipment.
d. To use circuit/problem solving software such as MultiSim, MathCAD, and/or Matlab.
e. To offer the student an opportunity to display his/her competency in both course work, laboratory procedures and problem-solving skills by doing in-lab demonstrations and presentations.

Mapping to Departmental Student Outcomes:

ECE Outcome	EE 230 Course Outcome
Ability to apply mathematics, science and engineering principles.	**a**
Ability to design and conduct experiments, analyze and interpret data.	**c**
Ability to identify, formulate and solve engineering problems.	**b**
Ability to communicate effectively.	**e**
Ability to use the techniques, skills and	**d**

modern engineering tools necessary for engineering practice.	

Topics list

a. Review - Kirchoff's Laws, Node-Voltage Method, Mesh-Current Method, Source Transformation, Thevenin and Norton Equivalents
b. Inductance, Capacitance, Mutual Inductance
c. Natural and Step Responses of First-order RL and RC Circuits
d. Natural and Step Responses of RLC circuits
e. Sinusoidal Steady-State Analysis
f. Circuit Elements in the Frequency Domain, and Phasor diagrams
g. Instantaneous Power, Complex Power, Power Calculations, Maximum Power Transfer
h. Balanced Three-Phase Circuits

EE 300 - Cornerstone Design

Course Number and Name: EE 300 Cornerstone Design
Credits: 2 credits
Instructor: Paul M. Furth
Text Book, Title, Author and Year: None
Other Supplemental Materials: None
Catalog Description: Application and realization of engineering principles to a guided team-based design project. Formulation and implementation of test procedures, evaluation of alternate solutions and oral and written communication of the design and test results.
Prerequisites: EE 212 and EE 230, **and Corequisites:** None.
Core, Specialization, Elective: ECE Core
Course Goal: Introduce students to the design process by applying basic knowledge of electrical and computer engineering to a in a team-based project.
Course Outcomes: At the end of EE 300, students will:

a. Formulate and implement test procedures for validation of requirements.
b. Evaluate alternative design solutions.
c. Document test procedures and design solutions.
d. Implement design to include a printed-circuit board, electronics and coding.
e. Communicate the design and validation both orally and in writing to a wide range of target audiences.

Mapping to Departmental Student Outcomes:

ECE Outcome	EE 300 Course Outcome
Ability to design and conduct experiments, analyze and interpret data.	**a**
Ability to design a system, component, or process to meet desired needs.	**b**
Ability to communicate effectively.	**c, e**
Ability to use the techniques, skills and modern engineering tools necessary for engineering practice.	**d**

Topics list

a. Project Scheduling
b. Design Requirements
c. Testing and Test Procedures
d. Electronic Measurements
e. Lab Notebooks
f. Design Process
g. Component Datasheets
h. Design Evaluation

i. Visio, PowerPoint
j. Word, LaTeX
k. Printed Circuit Board Layout
l. Bill of Materials
m. Soldering, Proto-typing

EE 320 - Signals and Systems I

Course Number and Name: EE 320 Signals and Systems I
Credits: 3 credits
Instructor: Steven Sandoval
Text Book, Title, Author and Year: *Signals and Systems, 2nd Edition* by Alan V. Oppenheim and Alan S. Willsky (ISBN-13: 978-0138147570)
Other Supplemental Materials: MATLAB software
Catalog Description: Continuous and discrete time signals and systems. Linear, time-invariant systems. Fourier series, continuous and discrete time Fourier transforms. Time and frequency characterization of signals and systems.
Prerequisites EE 200 and EE 230. **Corequisites:** MATH 392.
Core, Specialization, Elective: *Course is required for Engineering Physics students with the Electrical Concentration*
Course Goal: Provide students with an introduction to the fundamentals of signal analysis and system analysis.
Course Outcomes: At the end of EE 320, student will:

a. Understand different types of signals (continuous-time, discrete-time, periodic, etc.) and how these signals are represented mathematically and in a computer.
b. Understand systems representations (e.g., impulse responses), implementations (e.g., convolution and difference/differential equations), and properties (e.g., linearity).
c. Gain insight into transform-domain analysis for signals and systems.
d. Develop the ability to apply transform domain and LTI analysis to simple applications in signal processing, communications, and controls using MATLAB.

Mapping to Departmental Student Outcomes:

ECE Outcome	EE 320 Course Outcome
Ability to apply mathematics, science and engineering principles.	**a, d**
Ability to design a system, component, or process to meet desired needs.	**b, c**

Topics list

a. Continuous-time (CT) Signals and Discrete-time (DT) Signals
b. Signal Transformations and Signal Properties
c. Complex Exponential Signals, Harmonically-Related Complex Exponentials,
d. DT Unit Impulse and Unit Step, CT Impulse and Unit Step
e. CT and DT Systems, Basic System Properties
f. Linear, Time-Invariant (LTI) Systems Theory, DT Convolution
g. CT Sifting property, CT Convolution Properties of the Convolution Operator, Properties of LTI Systems
h. Causal LTI Systems Described by Differential and Difference Equations, Linear Constant-Coefficient Differential Equations

i. Linear Constant-Coefficient Difference Equations, Block Diagram Representations
j. Response of CT LTI Systems to Complex Exponentials, Response of DT LTI Systems to Complex Exponentials
k. CT Fourier Series, Fourier Series , Discrete-Time Fourier Series, CT Fourier Transform, Discrete-Time Fourier Transform (DTFT)
l. Magnitude-Phase Representation of the Fourier Transform, Magnitude-Phase Representation of the Frequency Response of LTI Systems
m. Linear and Non-Linear Phase, Group Delay, Log-Magnitude and Bode plots
n. First-Order CT Systems, Asymptotic Approximations to the Bode Plot, Second-Order CT Systems, Bode Plots for Rational Frequency Responses
o. Time-Domain Properties of Ideal Frequency-Selective Filters, Time-Domain Properties of Non-Ideal Frequency-Selective Filters

EE 340 - Fields and Waves

Course Number and Name: EE340 Fields and Waves
Credits: 4 credits
Instructor: Kwong T. Ng
Text Book, Title, Author and Year: *Fundamentals of Applied Electromagnetics, 6th edition,* Fawwaz T. Ulaby, Eric Michielssen, and Umberto Ravaioli (2010)
Other Supplemental Materials: ANSYS Designer, ANSYS HFSS, and MATLAB software
Catalog Description: Static electromagnetic field. Maxwell's equation and time-varying electromagnetic fields. Generalized plane wave propagation, reflection, transmission, superposition and polarization. Transmission line theory. Extensions to optical wave propagation. Applications including Time Domain Reflectometry (TDR) and fiber optic transmission. Laboratory experience with RF/microwave test equipment and optical apparatus. Restricted to Majors: Electrical Engineering.
Prerequisites and Corequisites: C- or better in EE 240
Core, Specialization, Elective: *Course is required for Engineering Physics students with the Electrical Concentration*
Course Goal: Provide students with a study of electromagnetic fields and their applications.
Course Outcomes: At the end of EE 340, student will:

a. Demonstrate an understanding of the fundamental principles, theories, and equations (such as Maxwell's) governing transmission lines, static and time-varying fields, propagation, reflection and transmission of plane waves, and waveguides.
b. Analyze and solve electromagnetic-related problems by applying fundamental principles, theories, and equations (such as Maxwell's equations and transmission line properties).
c. Demonstrate effective teamwork.
d. Demonstrate the use of RF/microwave test equipment and software to perform high frequency circuit measurements.

Mapping to Departmental Student Outcomes:

ECE Outcome	EE 340 Course Outcome
Ability to apply mathematics, science and engineering principles.	**a, b**
Ability to design and conduct experiments, analyze and interpret data.	**d**
Ability to function on multidisciplinary teams.	**c, d**
Ability to identify, formulate and solve engineering problems.	**a, b**

Topics list

a. Transmission Line and Distributed Circuit Theory, Transmission Line Circuit Design
b. Review of Electrostatics and Magnetostatics
c. Time-Varying Fields and Maxwell's Equations, Boundary Conditions
d. Plane Wave Propagation and Applications
e. Plane Wave Reflection and Transmission, and Applications
f. Analysis and Design of Waveguide Systems

EE 380 - Electronics I

Course Number and Name: EE380 Electronics I
Credits: 4 credits
Instructor: Jaime Ramirez-Angulo
Text Book, Title, Author and Year: *Microlectronic Circuits, 7th Edition*, Oxford University Press, Sedra and Smith (2017)
Other Supplemental Materials: Demo version of circuit simulation software TOPSPICE available at http://www.penzar.com/demopage.htm. EE380 component kit (available from instructor, cost: approximately $32/lab pair
Catalog Description:. Electronics I, Credits 4, Analysis and design of single time constant networks, op-amps applications, diode circuits, linear power supplies and single transistor MOS and BJT amplifiers. Introduction to solid-state devices and digital circuits
Prerequisites: C or better in EE162, EE280 and CHEM 111G. **Corequisites:** none
Core, Specialization, Elective: ECE Core
Course Goal: Provide students with proficiency analysis and design of diode circuits op-amp circuits and single stage amplifiers with MOS and BJT transistors.
Course Outcomes: At the end of EE 380, student will:

a. Apply knowledge from science, math and engineering to electronic circuit design.
b. Become proficient with lab equipment required to test electronic circuits.
c. Become proficient with software to capture and simulate electronic circuits
d. Understand the professional and ethical responsibilities related to electronic circuit design.
e. Understand how to characterize experimentally electronic circuits.
f. Become proficient with utilization of software for the design of PCBs
g. Maintain a knowledge of contemporary professional, societal and global issues as they relate to electronic circuits and VLSI systems.
h. Write lab reports

Mapping to Departmental Student Outcomes:

ECE Outcome	EE 380 Course Outcome
Ability to apply mathematics, science and engineering principles.	**A**
Ability to design a system, component, or process to meet desired needs.	**A**
Ability to communicate effectively.	**H**
Ability to use the techniques, skills and modern engineering tools necessary for engineering practice.	**B,C,E.F**

Topics list

a. Amplifier models: voltage, current, transconductance and transresistance. Analysis and design of single stage and multistage amplifiers. Frequency response of amplifiers
b. Single time constant networks: Transfer functions of first order low pass and high pass networks
c. Physical operation of PN junction.
d. Analysis of ideal op-amp circuits: Inverting, noninverting and differential configuration with resistive and frequency dependent elements
e. Non ideal op-amp characteristics: Finite DC gain, Finite bandwidth and gain-bandwidth product. DC offset, slew rate, Input bias currents. Frequency response of nonideal op-amp amplifiers.
f. Terminal characteristics of Ideal diodes. Analysis of circuits with ideal diodes. Terminal characteristics of nonideal diodes. Analysis of circuits with nonideal diodes. Analysis and design of diode circuits: rectifiers, power supplies, regulators, limiters, peak detectors, voltage doublers. Other diode types: photodiodes, LEDs.
g. Physical operation and terminal characteristics of MOS transistors. Biasing and small-signal models of MOS transistors. Small signal analysis of MOS single stage amplifiers: Common source, common drain and common gate amplifiers
h. Physical operation and terminal characteristics of Bipolar Junction Transistors (BJTs). Biasing and small-signal models of BJT circuits. Small signal analysis of BJT single stage amplifiers: Common emitter, common collector and common base amplifiers

EE 402 - Capstone Design
Course Number and Name: EE 402 Capstone Design
Credits: 3 credits
Coordinator: Satish J. Ranade
Text Book, Title, Author and Year: None
Other Supplemental Materials: None
Catalog Description: Application and realization of engineering principles to a significant team-based design project with significant student managment and autonomy. Determination of performance requirements, including safety, economics, ethics and manufacturability; extensive communication of design choices and test results to broad audiences; and interfacing of design with other hardware and software.
Prerequisites: EE 300, EE 317, EE 325, and EE 340
Core, Specialization, Elective: ECE Required
Course Goal: In EE 402 students demonstrate the ability to design a system with significant hardware and software components for a specific purpose.
Course Outcomes: In EE 402 students will:

a. Determine detailed performance requirements at the system and subsystem levels based on problem statement and/or customer objectives.
b. Incorporate appropriate safety, economic, ethical, and manufacturability constraints in requirements.
c. Formulate, implement, and document detailed test procedures for validation of requirements.
d. Develop methodology to justify choice of best design(s) in light of alternative design solutions.
e. Analyze project risk, provide a work breakdown structure, team management plan, and budget to ensure successful implementation of solution.
f. Implement the design, interfacing it with other hardware and software entities.
g. Validate the design implementation.
h. Communicate the design and validation both orally and in writing to a wide range of target audiences.

Mapping to Departmental Student Outcomes:

ECE Outcome	EE 402 Course Outcome
Ability to design and conduct experiments, analyze and interpret data.	**c, g**
Ability to design a system, component, or process to meet desired needs.	**a, d**
Ability to function on multidisciplinary teams.	**e**
Understanding of professional and ethical responsibility.	**b**
Ability to communicate effectively.	**h**

Ability to use the techniques, skills and modern engineering tools necessary for engineering practice.	**f**

Topics list

a. Team, individual, and peer reporting
b. Communicating with the customer to develop design requirements
c. Requirements testing, feasibility, and measurability
d. Safety class and ethics of designs
e. How to develop and track budget information
f. How to assess and communicate risk
g. Project scheduling and management
h. Communication to broad audiences
i. Documentation of design and testing (written and oral)
j. Intellectual property

EE 418 - Capstone I

Course Number and Name: EE 418 Capstone I
Credits: 3 credits
Coordinator: Satish J. Ranade
Text Book, Title, Author and Year: None
Other Supplemental Materials: None
Catalog Description: Application of engineering principles to a significant design project. Includes teamwork, written and oral communications, and realistic technical, economic, and public safety requirements.
Prerequisites: Complete all ECE Core classes with C- or better
Core, Specialization, Elective: *Engineering Physics Students with the Electrical Concentration can take this course to fulfill their capstone design requirement.*
Course Goal: In the EE418/419 sequence students demonstrate the ability to design a system with significant hardware and software components for a specific purpose.
Course Outcomes: In EE418 students will:

a. Convert a problem statement or customer objective into appropriate system requirements and propose solutions at a block-diagram level
b. Develop detailed subsystem requirements, alternate designs and methodology to identify best design(s)
c. Analyze project risk and provide a WBS, management plan(appropriate delegation and integration of individual team member tasks), and budget to ensure successful implementation of solution in EE 419
d. Complete design with demonstration of critical subsystem prototypes(s)
e. Be able to consider business, ethical and societal aspects of design work and communicate the progress of the design.

Mapping to Departmental Student Outcomes:

ECE Outcome	EE 460 Course Outcome
Ability to design and conduct experiments, analyze and interpret data.	**b, d**
Ability to design a system, component, or process to meet desired needs.	**b**
Ability to function on multidisciplinary teams.	**a, b, c**
Ability to identify, formulate and solve engineering problems.	**a**
Understanding of professional and ethical responsibility.	**d**
Ability to communicate effectively.	**d**
The broad education necessary to understand the impact of engineering solutions in a global and societal context.	**d**
Ability to use the techniques, skills and modern engineering tools necessary for engineering practice.	**c**

Topics list

a. NMSU Employee Safety Class
b. Ethics
c. Intellectual property
d. Group status Report and attendance log (Bi-Weekly)
e. Individual Status Report and Peer Review (Bi-weekly)
f. Elevator Speech, Youtube video, Safety Quiz
g. System Concept Review and report
h. Preliminary Design Review and report
i. Critical Design Review, to include prototype demonstration, and draft final report

EE 419- Capstone II

Course Number and Name: EE 419 Capstone II

Credits: 3 credits
Coordinator: Satish J. Ranade
Text Book, Title, Author and Year: None
Other Supplemental Materials: None
Catalog Description: Realization of design project from E E 418 within time and budget constraints.
Prerequisites: Complete all ECE Core classes with C- or better
Core, Specialization, Elective: *Engineering Physics Students with the Electrical Concentration can take this course to fulfill their capstone design requirement.*
Course Goal: In the EE418/419 sequence students demonstrate the ability to design a system with significant hardware and software components for a specific purpose.
Course Outcomes: In EE418 students will:

a. Implement, test and iterate design developed in EE418 to validate established requirements and constraints.
b. Implement and test interfaces to user and hardware and software entities if required
c. Document the design, implementation, test and usage; communicate both orally and in writing.
d. Appropriately delegate and integrate individual team member tasks.

Mapping to Departmental Student Outcomes:

ECE Outcome	EE 460 Course Outcome
Ability to design and conduct experiments, analyze and interpret data.	**a, b**
Ability to design a system, component, or process to meet desired needs.	**a, b**
Ability to function on multidisciplinary teams.	**d**
Ability to identify, formulate and solve engineering problems.	**a**
Ability to communicate effectively.	**c**
Knowledge of contemporary issues.	
Ability to use the techniques, skills and modern engineering tools necessary for engineering practice.	**a-d**

Topics list

a. Finalize system design and implementation schedule
b. Define test plan

c. Implement design
d. Perform and document subsystem/system tests
e. Document design via an overall report, reference manual, user manual and interface document
f. Communicate design and project progress through written reports and presentations

Engineering Physics Program
(Bachelor of Science in Engineering Physics)

at

New Mexico State University

Syllabi of Mechanical Engineering Courses

Course Information	**ME159 Graphical Communication and Design** 2 credits Required Fall 2017
INSTRUCTOR:	Mostafa Hassanalian Office: JH007 Phone: 449-0850 email: mhalian@nmsu.edu
ASSISTANTS:	NA
OFFICE HOURS:	M,TR,F 3:00-4:00pm or by appointment
CATALOG DESCRIPTION:	Sketching and orthographic projection. Covers detail and assembly working drawings, dimensioning, tolerance specification, and design projects.
PRE/COREQUISITES:	Math190
TEXT:	*NX 11 for Designers, Sham Tickoo, CADCIM Technologies, 2017.* *This is a Canvas course – Go to https://my.nmsu.edu>LaunchPad>Canvas or use https://nmsu.instructure.com/login directly in the web browser.*
CLASS SCHEDULE:	Lecture: 1:10 p.m. - 2:10 p.m. - T - EC2 103 Section M02 & M04 Lab: 2:10 p.m. - 5:00 p.m. - T - EC1 210A &210B Lecture: 1:30 p.m. - 2:20 p.m. - W - EC2 103 Section M01 & M03 Lab: 2:30 p.m. - 5:20 p.m. - W - EC1 210A &210B Lab Hours Outside of Class for Doing Homework: 8:00 a.m. – 5:00 p.m. - Jett Hall 004 Open for 24 Hours – Hernandez Hall Computer Lab
GRADES:	Quizzes ~10% Labs/Homework ~50% Project ~20% Final Exam ~20% (possible +10% with Extra Credit))
COURSE OBJECTIVES:	• The student will become familiar with 3-D, featured based, parametric solids modeling as a design tool in mechanical engineering. (ME4) • The student will become familiar with the practices and procedures used to produce and read engineering working drawings (c). • The student will become familiar with computers from an historical, software, and hardware perspective as they are used in mechanical engineering (k). • The student will become familiar with the general principles of computer aided design and drafting (CADD), and be reasonably proficient in the use of one modern CADD software package – Unigraphics NX from Siemens Corporation. (k)
TOPICS COVERED:	<u>Using Unigraphics NX</u> • Feature-based solids modeling – creation of basic and intermediate features • NX as a design tool - building design intent into models • Assembly modeling

Course Information	**ME159 Graphical Communication and Design** 2 credits Required Fall 2017
	• Crea ting engineering drawings of parts and assemblies <u>Practices and Procedures Used to Produce Engineering Drawings</u> • Creating 2D orthographic drawings of 3D objects – standard views, required views, placement, etc. • Required drawing dimensions – identify features, decide how many dimensions, etc. • Good dimensioning practices – where paced in drawing? How should they look? • Reading engineering drawings – using 2D orthographic views and dimensions to infer 3D shape
RELATIONSHIP TO PROGRAM OUTCOMES:	c ability to design a system, component or process to meet desired needs within realistic constraints k ability to use the techniques, skills and modern tools necessary for engineering practice
CONTRIBUTION TO PROFESSIONAL COMPONENT:	PC3 1 1/2 years engineering topics (engineering science and design)
RELATIONSHIP TO ABETSPECIFIC CRITERIA:	ME4 ability to work professionally in both thermal and mechanical systems areas
POLICIES:	• Homework is due at the <u>***beginning***</u> of the next class lecture. No assignments or homework will be accepted after that time. • Students cannot miss <u>***more than three lectures***</u>. • Students who fail in the final exam with a grade less than <u>***25%***</u> will <u>***automatically fail the course***</u>.. • Paper for printing up to 200 sheets during the semester will be supplied free of charge. Printing beyond that amount will be charged at the rate of 5¢/page (see administrative assistant in EC). • **ALL** absences must be "excused"; otherwise a **0** will be recorded for that Lecture/Lab Assignment. Communicate with the instructor as soon as you know that you will miss the class. Because of limited space/machines, any make-up work must be coordinated with the instructor. • Plagiarism is using another person's work without acknowledgment, making it appear to be one's own. Intentional and unintentional instances of plagiarism are considered instances of academic misconduct and are subject to disciplinary action such as failure on the assignment, failure of the course or dismissal from the university.
AUTHOR/DATE:	Mostafa Hassanalian October 2017

Course Information	**ME 236 Engineering Mechanics I** 3 credits Required Fall 2017
INSTRUCTOR:	Dr. Borys Drach Office: JH234 Phone: 646-8041 email: borys@nmsu.edu
ASSISTANTS:	NA
OFFICE HOURS:	MW 2:30 – 3:30pm, Jett Hall 234 or by appointment (via e-mail)
CATALOG DESCRIPTION:	Force systems, resultants, equilibrium, distributed forces, area moments, friction, and kinematics of particles.
PREREQUISITES:	Math 192G
PRE/COREQUISITES:	PHYS 215G
TEXT:	Russell C. Hibbeler "Engineering Mechanics: Statics", 14th edition, Pearson, ISBN-10: 0133918920, ISBN-13: 978-0133918922 + "MasteringEngineering" access
CLASS SCHEDULE:	MWF 11:30am – 12:20pm, Jett Hall 210
GRADES:	In-class assignments 5% Homework 10% Midterm exam 1 25% Midterm exam 2 25% Final exam 35%
COURSE OBJECTIVES:	After completing this course, a student should have: • understanding of Static Particle and Body Equilibrium • understanding of Equivalent Force Systems • understanding of Simple Truss and Frame Structural Analyses • understanding of Dry Friction and proficiency in Dry Friction analysis • understanding of Center of Gravity and Geometric Centroid • understanding of Area and Mass Moments of Inertia • understanding of Kinematics of Particles • proficiency in developing Mathematical Models (a) • ability to use knowledge acquired in the course to formulate, solve and interpret solutions of engineering problems(e)
TOPICS COVERED:	• Vector Algebra • Particle Equilibrium • Equivalent Force Systems • Rigid Body Equilibrium • Structural Analysis of Trusses, Frames and Machines • Friction • Center of Gravity and Centroid • Area and Mass Moments of Inertia • Kinematics of Particles

Course Information	**ME 236 Engineering Mechanics I** 3 credits Required Fall 2017
RELATIONSHIP TO PROGRAM OUTCOMES:	a ability to apply knowledge of mathematics, science, and engineering e ability to identify, formulate, and solve engineering problems
CONTRIBUTION TO PROFESSIONAL COMPONENT:	PC3 1 1/2 years engineering topics (engineering science and design)
RELATIONSHIP TO ABET SPECIFIC CRITERIA:	ME2 ability to apply advanced mathematics, multivariate calculus, and differential equations
POLICIES:	• Students are expected to attend all lectures. Attendance will be tracked via in-class assignments. Attendance will be taken into account during final grading. • Use of electronic devices in the course is not permitted. • Homework will be assigned, submitted and graded via the online system “MasteringEngineering” (online access is required) • Discussion of the homework solution is not permitted. You must work alone. • No credit will be given for late homework. • Dates and format of the exams will be discussed in class. Exams cannot be retaken. All make-up arrangements must be discussed with the instructor before the date of the exam. Make-up exams will only be allowed in extraordinary cases • **Zero tolerance policy**. A student suspected of cheating will receive zero for the assignment and the incident will be reported to the College administration, see below. • **College policy**. The College of Engineering has a “2 strikes and you’re out” policy for academic misconduct. This means that a student will be suspended after found guilty of two academic misconduct cases. Suspension means out for one year. A strike can count from academic misconduct occurring in any college. Academic Misconduct Policy: http://studenthandbook.nmsu.edu/student-code-of-conduct/academic-misconduct/ Plagiarism is using another person's work without acknowledgment, making it appear to be one's own. Intentional and unintentional instances of plagiarism are considered instances of academic misconduct and are subject to disciplinary action such as failure on the assignment, failure of the course or dismissal from the university. For source and more information visit http://lib.nmsu.edu/plagiarism/
AUTHOR/DATE:	Borys Drach October 2017

Course Information	**ME 237 Engineering Mechanics II** 3 credits Required Fall 2017
INSTRUCTOR:	Dr. V. Choo Office: JH130 Phone: 646-2225 email: vchoo@nmsu.edu
ASSISTANTS:	NA
OFFICE HOURS:	Email or by appointment
CATALOG DESCRIPTION:	Kinetics of particles, kinematics and kinetics rigid bodies, systems of particles, energy and momentum principles, and kinetics of rigid bodies in three dimensions.
PREREQUISITES:	ME 236 or CE 233
PRE/COREQUISITES:	Math 291
TEXT:	*Engineering Mechanics: Dynamics, 14th Ed., Russell C. Hibbeler, Pearson Education, ISBN-10: 0133915387, ISBN-13: 9780133915389..*
CLASS SCHEDULE:	Lecture: 12:30 P.M. - 1:20 P.M. - MWF - JH 210 M01
GRADES:	Homework: 10% Formative Test 1 and Test 2: 10% each Summative Test1: 35% Summative Test2: 35%
COURSE OBJECTIVES:	After completing this course, a student should be able to: • develop Mathematical Models (FBD's) • analyze the Kinematic and Kinetic Problems of Particles • apply the Energy and Momentum Principles to Particles in Motion • analyze the Kinematic and Kinetic Problems of Rigid Bodies in Planar Motion • apply the Energy and Momentum Principles for Planar Motion of Rigid Bodies • analyze the Kinematic and Kinetic Problems of Rigid Bodies in Three Dimensional Motion • use the knowledge acquired in this course to formulate, solve and interpret solutions of engineering problems.(e)
TOPICS COVERED:	• Vector Algebra and Static Equilibrium • Kinematics and Kinetics, Energy and Momentum principles for: Particles in Motion Rigid Bodies in Planar Motion Rigid Bodies in Three Dimensional Motion • Moments and Products of Inertia • Relative Motion and Moving Reference Frame

Course Information	**ME 237 Engineering Mechanics II** 3 credits Required Fall 2017
RELATIONSHIP TO PROGRAM OUTCOMES:	e ability to identify, formulate, and solve engineering problems
CONTRIBUTION TO PROFESSIONAL COMPONENT:	PC3 1 1/2 years engineering topics (engineering science and design)
RELATIONSHIP TO ABET SPECIFIC CRITERIA:	ME2 ability to apply advanced mathematics, multivariate calculus, and differential equations
POLICIES:	• Homework assignments must include (1) problem description, (2) mathematical model(s), (3) formulation of solution, (4) presentation of mathematical procedures used and (5) results. • Late homework assignments will not be accepted. • Collaboration in the form of discussion of formulation of solutions or results is encouraged; however, each individual must work independently to create the required solutions to homework assignments.
AUTHOR/DATE:	V. Choo August 2017

Course Information	**ME 240 Thermodynamics** 3 credits Required Fall 2017
INSTRUCTOR:	Krishna Kota Office: JH 128 Phone: 646-5720 Email: kkota@nmsu.edu
ASSISTANTS:	Lazar Cvijovic
OFFICE HOURS:	2:30 to 4:00 p.m. TR or by appointment
CATALOG DESCRIPTION:	First and second laws of thermodynamics, irreversibility and availability, applications to pure substances and ideal gases.
PREREQUISITES:	Phys 215G
TEXT:	*Çengel, Y. A. and Boles, M. A., Thermodynamics: An Engineering Approach, 8th ed., the McGraw-Hill Companies, Inc., New York, © 2015,* ISBN-13: 978-007-3398174 This is a Canvas course – http://learn.nmsu.edu
CLASS SCHEDULE:	Lecture: 11:45 a.m. - 1:00 p.m. - TR – JH 207
GRADES:	Homework 15%, Quizzes 25% Midterm exam 25%, Final Exam 35%
COURSE OBJECTIVES:	• The student will be able to determine properties of real substances, such as steam and refrigerant 134-a, and ideal gases from either tabular data or equations of state. (e) • The student will be able to analyze processes involving ideal gases and real substances as working fluids in both closed systems and open systems (systems and control volumes) to determine process diagrams, apply the first law of thermodynamics to perform energy balances, and determine heat and work transfers. (e) • The student will be able to analyze closed and open systems through the application of the second law. (e) • The student will be able to analyze the Rankine cycle.(e)
TOPICS COVERED:	• Basic Thermodynamic concepts • Introduction to energy and the First Law • Properties of pure substances • First Law for closed systems • First Law for open systems • The Second Law • Entropy and First and Second Law applications • Introduction to power cycles • Reviews and Exams

Course Information	**ME 240 Thermodynamics** 3 credits Required Fall 2017
RELATIONSHIP TO PROGRAM OUTCOMES:	e ability to identify, formulate, and solve engineering problems
CONTRIBUTION TO PROFESSIONAL COMPONENT:	PC3 1 1/2 years engineering topics (engineering science and design)
RELATIONSHIP TO ABET SPECIFIC CRITERIA:	ME2 ability to apply advanced mathematics, multivariate calculus, and differential equations ME4 ability to work professionally in both thermal and mechanical systems areas
POLICIES:	• Homework: 5-8 homeworks will be assigned in this course and selected problems from each of them will be graded. Please submit the solutions to homework problems before the end of class on the prescribed due date. Late homeworks will not be accepted. • Quizzes and Exams: Text book, class notes or any other material is not allowed during exams and quizzes. Usage of any kind of electronic device (including smart phones) is not permitted. All electronic devices must be muted and stored in your backpacks, which must be kept in front of the class room at least five minutes before an exam. Sharing of calculators is not allowed. Please bring your own calculator. Discussions of any kind are not allowed. You can only speak with the instructor or the TA. Violation of any of the above discussed exam policies will be considered as cheating for which a zero will be awarded on that exam. • Additional Exam and Classroom Policies & Recommendations: Pen vs. pencil policy · Exam proctoring policy · Restroom usage policy • Please try to attend all the classes. • Please try to be in the class room on time. If you arrive late, please quietly occupy a seat without disturbing the lecture or other students. • Please check CANVAS frequently for announcements and updates. • It is strongly recommended to refrain from using smart phones in the classroom.
AUTHOR/DATE:	K. Kota August 2017

Course Information	**ME 261 Mechanical Engineering Problem Solving** 3 credits Required Fall 2017
INSTRUCTOR:	Dr. Gabe Garcia Office: JH104 Phone: 646-3503 email: gabegarc@nmsu.edu
ASSISTANTS:	TBA
OFFICE HOURS:	9:30 a.m.- 12:00 p.m. TR 3:00 p.m.-5:00 p.m. T or by appointment
CATALOG DESCRIPTION:	Introduction to programming syntax, logic, and structure. Numerical techniques for root finding, solution of linear and nonlinear systems of equations, integration, differentiation, and solution of ordinary differential equations will be covered. Multi function computer algorithms will be developed to solve engineering problems.
PREREQUISITES:	Math 192
TEXT:	*NONE*
CLASS SCHEDULE:	Lecture: MW 08:30 a.m. - 09:20 a.m. EC 110 Sections M1A, M1B Lab: M 2:30 p.m. - 5:20 p.m. JH 245 Section M1A Lab: R 5:35 p.m. - 8:25 p.m. JH 245 Section M1B
GRADES:	Homework: 2.5% Lab Work: 2.5% Exam1: 15% Exam2: 30% Exam3: 25% Exam4: 25%
COURSE OBJECTIVES:	• Students will learn a variety of numerical methods that are useful in both basic and advanced engineering calculations. (a) • Students will learn how to formulate algorithms and write programs to solve engineering problems. (e) • Students will develop an appreciation for the hazards and limitations of numerical solutions, including accuracy, stability, and computer limitations of memory and speed. (k)
TOPICS COVERED:	• MATLAB Program Environment • MATLAB Functions • Roots of Equations • Linear systems of equations • Non Linear systems of equations • Interpolation and Curve fitting • Numerical differentiation and integration • Solution of Ordinary differential equations

Course Information	**ME 261 Mechanical Engineering Problem Solving** 3 credits Required Fall 2017
RELATIONSHIP TO PROGRAM OUTCOMES:	a ability to apply knowledge of mathematics, science, and engineering e ability to identify, formulate, and solve engineering problems k ability to use the techniques, skills and modern tools necessary for engineering practice
RELATIONSHIP TO ABET SPECIFIC CRITERIA:	ME2 ability to apply advanced mathematics, multivariate calculus, and differential equations ME3 familiarity with statistics and linear algebra
ASSIGNMENT POLICIES:	• All computer programs must be written in MATLAB as instructed and well commented. • All Homework and Labs must be submitted through CANVAS by the assignment due date and time. Note that CANVAS will not allow you to upload after the due date and time so make sure you give yourself enough time to get your assignments uploaded. • Late assignments will be assigned a zero grade. Collaboration in the form of discussion of formulation of solutions or results is encouraged; however, each individual must work independently to create the solution and computer programs.
Student Accessibility Services:	Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act (ADA) covers issues relating to disability and accommodations. If a student has questions or needs an accommodation in the classroom (all medical information is treated confidentially), contact: Trudy Luken Student Accessibility Services (SAS) - Corbett Center, Rm. 244 Phone: 646.6840 E-mail: sas@nmsu.edu • Website: www.nmsu.edu/~ssd/
Institutional Equity:	NMSU policy prohibits discrimination on the basis of age, ancestry, color, disability, gender identity, genetic information, national origin, race, religion, retaliation, serious medical condition, sex, sexual orientation, spousal affiliation and protected veterans status. Furthermore, Title IX prohibits sex discrimination to include sexual misconduct, sexual violence, sexual harassment and retaliation.
POLICIES:	Plagiarism is using another person's work without acknowledgment, making it appear to be one's own. Intentional and unintentional instances of plagiarism are considered instances of academic misconduct and are subject to disciplinary action such as failure on the assignment, failure of the course or dismissal from the university. The NMSU Library has more information and help on how to avoid plagiarism at http://lib.nmsu.edu/plagiarism/
AUTHOR/DATE:	G. Garcia August 2017

Course Information	**ME 326 Mechanical Design** 3 credits Required Spring 2018
INSTRUCTOR:	Ali Seyedkavoosi Office: JH115 Phone: 646-6533 email: akavoosi@nmsu.edu
ASSISTANTS:	Norberto Di Stefano
OFFICE HOURS:	2:30 p.m.- 3:30 p.m. TR or by appointment
CATALOG DESCRIPTION:	Design methodology and practice for mechanical engineers.
PREREQUISITES:	ME 237 and CE 301
TEXT:	*Fundamentals of Machine Component Design, 7th Ed., Juvinal and Marshek, Wiley, 2006*
CLASS SCHEDULE:	Lecture: 11:30 a.m. - 12:20 p.m. - MW - JH 213 Lab: 12:30 p.m. - 1:20 p.m. - MWF - JH 213
GRADES:	Homework and Attendance: 10% In-Class Assignments and Quizzes: 10% Midterm exam: 20% Project: 20% Final Exam: 40%
COURSE OBJECTIVES:	• Conduct experiments and analyze data (b) • Major design experience (c) • Team working (d) • Professional and ethical responsibilities (f) • Knowledge of contemporary issues (j)
TOPICS COVERED:	• Loads Analysis • Design Methods • Deflection Analysis • Case studies • Professional practice • Safety
RELATIONSHIP TO PROGRAM OUTCOMES:	c ability to design a system, component or process to meet desired needs within realistic constraints d ability to function on multidisciplinary teams f understanding of professional and ethical responsibility j knowledge of contemporary issues
RELATIONSHIP TO ABET SPECIFIC CRITERIA:	ME2 ability to apply advanced mathematics, multivariate calculus, and differential equations

Course Information	**ME 326 Mechanical Design** 3 credits Required Spring 2018
	ME4 ability to work professionally in both thermal and mechanical systems areas
POLICIES:	• Students are expected to attend all lectures. Attendance will be tracked via in-class assignments. Note that attendance will be considered during final grading. • Students are expected to come in on time. If a lecture is already in progress, a student shall enter quietly and take the nearest seat without distracting others. • -%20 for submitting late homework to 2 hours and no credit will be given for submitting after 2 hours late homework. • Exams cannot be retaken. • All make-up arrangements must be discussed with the instructor before the date of the exam. Make-up exams will only be allowed in extraordinary cases. • Grades will be normalized. Then, A 100-90; B 89-80; C 79-70, D 69-60, etc.
AUTHOR/DATE:	Ali Seyedkavoosi 01/17/2018

Course Information	**ME 338 Fluid Mechanics** 3 credits Required Fall 2017
INSTRUCTOR:	Dr. C. Hocut Office: JH 228 Phone: 646-6034 email: chocut@nmsu.edu
ASSISTANTS:	Edgar Gonzalez
OFFICE HOURS:	3:30 p.m.- 5:30 p.m. T, TH or by appointment
CATALOG DESCRIPTION:	Properties of fluids. Fluid statics and fluid dynamics. Applications of the conservation equations continuity, energy, and momentum to fluid systems.
PREREQUISITES:	M E 234 or M E 237 and M E 228 or MATH 392
PRE/COREQUISITES :	None
TEXT:	*Fundamentals of Fluid Dynamics, J. Wiley, B.R. Munson, D.F. Young and T.H. Okiishi, and W.W. Huebsch, 7th edition, 2012*
CLASS SCHEDULE:	Lecture: 8:30 a.m. - 9:20 p.m. – MWF - GT 336
GRADES:	Homework: 10% Two exams: 60% Final: 30%
COURSE OBJECTIVES:	Develop a basic proficiency in: • Ability to analyze hydrostatic loading problems (a,e). • Applications of mass, momentum and energy conservation laws to fluid mechanics problems (a,e). • Applications of dimensional analysis and dynamic similitude (b,e). • Development of understanding of empirical formulations for internal and external flows (c,e).
TOPICS COVERED:	• Fluid Statics • Bernoulli's Equation & Fluid Dynamics • Integral Approach and Control Volumes • Dimensional Analysis • Internal Flow – Pipe Flows
RELATIONSHIP TO PROGRAM OUTCOMES:	a ability to apply knowledge of mathematics, science, and engineering b ability to design and conduct experiments, as well as to analyze and interpret data c ability to design a system, component or process to meet desired needs within realistic constraints e ability to identify, formulate, and solve engineering problems
CONTRIBUTION TO PROFESSIONAL COMPONENT:	PC2 1 year math and basic science PC3 1 1/2 years engineering topics (engineering science and design)

Course Information	**ME 338 Fluid Mechanics** 3 credits Required Fall 2017
RELATIONSHIP TO ABET SPECIFIC CRITERIA:	ME2 ability to apply advanced mathematics, multivariate calculus, and differential equations ME4 ability to work professionally in both thermal and mechanical systems areas
POLICIES:	• Final grades will be determined using the following grading scale: A=>85, B=75-84, C=65-74, D=50-65, F=<50. Graded material will include homework, two exams and a comprehensive final.
AUTHOR/DATE:	C. Hocut November 2017

Course Information	**ME 341 Heat Transfer** 3 credits Required Fall 2017
INSTRUCTOR:	Dr. Krishna Kota Office: JH 128 Phone: 646-5720 E-mail: kkota@nmsu.edu
ASSISTANTS:	Lazar Cvijovic
OFFICE HOURS:	2:30 p.m.- 4:00 p.m. TR or by appointment
CATALOG DESCRIPTION:	Fundamentals of conduction, convection, and radiation. Design of heat transfer systems.
PREREQUISITES:	ME 240, ME 328
TEXT:	*Fundamentals of Heat and Mass Transfer, 7th Edition by Theodore L. Bergman, Adrienne S. Lavine, Frank P. Incropera, David P. DeWitt, Wiley, ISBN-13: 978-0470501979; ISBN-10: 0470501979*
CLASS SCHEDULE:	Lecture: 1:30 p.m. - 2:20 p.m. - MWF - JH 213
GRADES:	Homework 15% Quizzes 25% Midterm Exam 25% Final Exam 35%
COURSE OBJECTIVES:	• At the end of this course, it is anticipated that the students would have gained -A thorough understanding of the three modes of heat transfer (conduction, convection, and radiation) -Basic knowledge required to apply heat transfer principles to practical and contemporary engineering problems (primarily in thermal management and energy and power generation systems) -The skills necessary to be successful in their professional duties in employment or further educational pursuits and be able to clearly communicate, formulate, analyze and creatively deduce solutions to technical problems in the area of heat transfer.
TOPICS COVERED:	Thermal Resistance Analysis, Steady-State Conduction, Transient Conduction, Internal Convection, External Convection, Free Convection, Heat Exchangers, Radiation Properties and Processes, Radiation Exchange Between Surfaces, Applications and Design
RELATIONSHIP TO PROGRAM OUTCOMES:	a ability to apply knowledge of mathematics, science, and engineering e ability to identify, formulate, and solve engineering problems
CONTRIBUTION TO PROFESSIONAL COMPONENT:	PC3 1 1/2 years engineering topics (engineering science and design)

Course Information	**ME 341 Heat Transfer** 3 credits Required Fall 2017
RELATIONSHIP TO ABET SPECIFIC CRITERIA:	ME2 ability to apply advanced mathematics, multivariate calculus, and differential equations ME4 ability to work professionally in both thermal and mechanical systems areas
POLICIES:	• Homework: 5-8 homeworks will be assigned in this course and selected problems from each of them will be graded. Please submit the solutions to homework problems before the end of class on the prescribed due date. Late homeworks will not be accepted. • Quizzes and Exams: Text book, class notes or any other material is not allowed during exams and quizzes. Usage of any kind of electronic device (including smart phones) is not permitted. All electronic devices must be muted and stored in your backpacks, which must be kept in front of the class room at least five minutes before an exam. Sharing of calculators is not allowed. Please bring your own calculator. Discussions of any kind are not allowed. You can only speak with the instructor or the TA. There will be no make-up exams or make-up quizzes. If you know beforehand that you will miss an exam or quiz, please contact me to discuss options at least two days before the scheduled exam/quiz date. Any kind of discussion concerning a make-up exam/quiz will not be entertained after the actual exam/quiz date. Quiz dates will be announced ahead; there will be no surprise quizzes. The final exam date/time (Monday, December 04, 01:00 PM – 03:00 PM) is decided by the university and it will not be changed. Rescheduling of exams can be done only with the permission of the Department Head and if there is a valid reason (legal, medical etc.). Please write your name legibly on your question papers, equation sheets and all your answer sheets during exams/quizzes and on your homeworks. Otherwise, they will not be graded. Violation of any of the above discussed exam policies will be considered as cheating for which a zero will be awarded on that exam. • Additional Exam and Classroom Policies & Recommendations: Pen vs. pencil policy · Exam proctoring policy · Restroom usage policy Please try to attend all the classes. .
AUTHOR/DATE:	K. Kota August 2017

Course Information	**ME 345 Experimental Methods I** 3 credits Required Fall 2017
INSTRUCTOR:	Dr. Vincent Choo Office: JH130 Phone: 646-2225 email: vchoo@nmsu.edu
ASSISTANTS:	Ryan Gabaldon, Joshua Budish
OFFICE HOURS:	via email or by appointment
CATALOG DESCRIPTION:	Emphasis on experimental techniques, basic instrumentation, data acquisition and analysis, and written presentation of results. Includes experiments in dynamics and deformable body mechanics.
PREREQUISITES:	Math 392, ME 237, and ME 240
PRE/COREQUISITES :	CE 301
TEXT:	*Lecture Notes*
CLASS SCHEDULE:	Lecture: 9:30 A.M. - 10:20 A.M. - MW – TB 104 Lab: See Course Schedule - JH 233
GRADES:	Summative Tests (2@35% ea.) 70% Homework/Class Quizzes/Formative Tests: 5% Lab Quizzes: 10% Lab Reports: 10% Oral Presentation: 5%
COURSE OBJECTIVES:	On the completion of this course, students will be able to: • design and conduct experiments using basic instrumentation (b, k) • carryout experimental data acquisition (k) • conduct statistical experimental data analysis and interpret data (b) • effectively communicate orally and in written format (g) • work on a team (g) • write technical reports (g)
TOPICS COVERED:	• LabView programming for experimental data acquisition • Statistical analysis of experimental data • Uncertainty analysis • Design, fabrication and calibration of force transducers • Vibration • Wheatstone bridge • Normal strain measurement • Shear strain measurement • Normal Strain correction • Shear Strain correction • Ultrasonic NDE of isotropic and homogeneous materials

Course Information	**ME 345 Experimental Methods I** 3 credits Required Fall 2017
RELATIONSHIP TO PROGRAM OUTCOMES:	b ability to design and conduct experiments, as well as to analyze and interpret data g ability to communicate effectively k ability to use the techniques, skills and modern tools necessary for engineering practice
CONTRIBUTION TO PROFESSIONAL COMPONENT:	PC3 1 1/2 years engineering topics (engineering science and design)
RELATIONSHIP TO ABET SPECIFIC CRITERIA:	ME3 familiarity with statistics and linear algebra
POLICIES:	• Attend all lectures and laboratory classes. No late homework assignments will be accepted.
AUTHOR/DATE:	V. Choo August 2017

Course Information	**ME 425 Design of Machine Elements** 3 credits Required Spring 2018
INSTRUCTOR:	Ahmed Kanaan Office: JH115 Phone: email: alhrdop@nmsu.edu
ASSISTANTS:	NA
OFFICE HOURS:	1:15 p.m.- 2:15 p.m. Tu&Th or by appointment
CATALOG DESCRIPTION:	Design of machine elements through the application of mechanics. Fatigue and theories of failure. Design projects assigned.
PREREQUISITES:	ME 326
TEXT:	*Fundamentals of Machine Component Design, 4th Ed., R.C. Juvinall and K.M. Marshek, Wiley, 2009*
CLASS SCHEDULE:	Lecture: 11:45 a.m. - 1:00 p.m. - TR - JH 205
GRADES:	Homework: 30% Quizzes: 20% Project: 25% Final Exam: 25%
COURSE OBJECTIVES:	• Perform load analyses on machine element parts and assemblies. • Perform stress and strain analyses on machine elements and determine element deflections. • Utilize standard failure theories and fatigue analysis to develop safety factors and reliability for machine elements. • Select materials for machine elements and machine element assemblies. • Design machine elements and machine element assemblies. • Work effectively as part of a design team.
TOPICS COVERED:	• Load analysis, especially free body diagrams • Materials • Stress, including Mohr's Circle • Deflections • Failure theories and fatigue analysis • Bearings, gears, and shafts • Project
RELATIONSHIP TO PROGRAM OUTCOMES:	a ability to apply knowledge of mathematics, science, and engineering c ability to design a system, component or process to meet desired needs within realistic constraints e ability to identify, formulate, and solve engineering problems k ability to use the techniques, skills and modern tools necessary for engineering practice

Course Information	**ME 425 Design of Machine Elements** 3 credits Required Spring 2018
RELATIONSHIP TO ABET SPECIFIC CRITERIA:	ME4 ability to work professionally in both thermal and mechanical systems areas
POLICIES:	• All homework is due the period following its assignment. • Homework must be submitted on time unless prior arrangements have been made with the instructor.
AUTHOR/DATE:	Name Ahmed Kanaan Date5/4/18

Course Information	**ME 426/427 Design Project Laboratory I & II** 6 credits Required FA 2017
INSTRUCTOR:	Dr. Young H. Park Office: JH 111 Phone: 646-3092 email: ypark@nmsu.edu
ASSISTANTS:	Edward Rojas
OFFICE HOURS:	8:00 a.m.- 9:00 a.m. MTWRF or by appointment
CATALOG DESCRIPTION:	Students address a design problem in which innovation and attention to detail are emphasized. Solution of the problem entails applications of mechanics and/or the thermal sciences. --- ME 426 Continuation of M E 426 --- ME 427
PREREQUISITES:	ME 326 and (ME 338 or AE 339) --- ME 426 ME 426 --- ME 427
PRE/COREQUISITES :	ME 425 and ME 341 --- ME 426
TEXT:	*None*
CLASS SCHEDULE:	Lecture: 3:30 p.m. - 6:20 p.m. - M – EC2 103 3:30 p.m. - 6:20 p.m. - W – EC2 103
GRADES:	Class Participation: 20% Individual & team performance: 30% Group Deliverable: 50%
COURSE OBJECTIVES:	• Have experience functioning as mechanical engineer within an engineering design and development group. (d) • Complete a real-life design task – transform a client's needs into a tangible, tractable project definition, and see the project through to completion. (c) • Understand and use a formal engineering design method, with emphasis on building concurrent engineering procedures into the basic design method. (c) • Become proficient in collaboratively preparing and reviewing formal technical design package related to an engineering design including final design binder and report (g) • Become proficient in written communication and be able to write an effective report (WQI)
TOPICS COVERED:	• Participation in a project team • Use of technical tools from past engineering courses • Strengthening of teaming skills • Learning how to apply engineering fundamentals to the design
RELATIONSHIP TO PROGRAM	B ability to formulate, analyze, and creatively participate in the solution of multidisciplinary problems through use of modern engineering

Course Information	**ME 426/427 Design Project Laboratory I & II** 6 credits Required FA 2017
EDUCATIONAL OBJECTIVES:	C ability to communicate clearly and effectively with fellow engineers, employers and general public D skills needed to fulfill professional duties and responsibilities in teamwork, collegiality, ethics, technical leadership, etc.
RELATIONSHIP TO PROGRAM OUTCOMES:	c ability to design a system, component or process to meet desired needs within realistic constraints d ability to function on multidisciplinary teams g ability to communicate effectively
CONTRIBUTION TO PROFESSIONAL COMPONENT:	PC1 major design experience PC3 1 1/2 years engineering topics (engineering science and design)
RELATIONSHIP TO ABET SPECIFIC CRITERIA:	ME4 ability to work professionally in both thermal and mechanical systems areas
POLICIES:	• None
AUTHOR/DATE:	Y. Park August 2017

Other Courses

Engineering Physics Program

(Bachelor of Science in Engineering Physics)

at

New Mexico State University

Syllabi of Other Required Courses (English, Communications, Mathematics, Chemistry, General Engineering, Civil Engineering)

(in alphabetical order of course acronym)

CE 301. Mechanics of Materials (3)

1. Course number and name: CHEM 111G. General Chemistry I

2. Credits and contact hours: 3 credit hours (class meets 150 minutes per week for lecture)

3. Instructor's or course coordinator's name: Craig Newtson

4. Text book, title, author, and year

"Mechanics of Materials" R.C. Hibbeler, 10th Edition, 2016

a. other supplemental materials: none

5. Specific course information

a. catalog description: Stress, strain, and elasticity of materials.

b. prerequisites: C E 233 – Mechanics – Statics or M E 236 – Engineering Mechanics I (prerequisite)

c. required, elective, or selected elective: This course is required for Engineering Physics majors with the Aerospace and Mechanical Concentrations.

6. Specific goals for the course

a. At the end of the course the student will be able to: (1) Calculate deformations, stresses, and strains of various types of members under loading; (2) Calculate principal stresses and strains; (3) Perform two-dimensional stress and strain transformation; (4) Analyze statically indeterminate structures using the method of consistent deformations; (5) Construct shear and moment diagrams for beam type structures; (6) Calculate beam deflections and rotations using various methods.

b. *This course provides measures for Student Outcomes (a), (c) and (e)*

7. Brief list of topics to be covered

- Stress; Strain; Stress-Strain Relationships
- Normal Stress; Shear Stress; Bearing Stress
- Factor of Safety and Simple Design
- Stresses on Oblique Planes
- Hooke's Law
- Axial Deformation
- Statically Indeterminate Problems
- Torsion of Circular Shafts; Power
- Bending
- Composite Materials
- Eccentric Loads
- Beam Shear and Moment Equations; Shear and Moment Diagrams; Beam Design
- Shear Stress; Shear Flow
- Mohr's Circle
- Combined Loads
- Pressure Vessels
- Beam Deflections
- Indeterminate Beam Analysis
- Columns

CHEM 111G. General Chemistry I (4)

1. Course number and name: CHEM 111G. General Chemistry I

2. Credits and contact hours: 4 credit hours (3 credit hours for lecture, 1 credit hour for lab)

3. Instructor's or course coordinator's name: Antonio Lara

4. Text book, title, author, and year

- Chemistry—an Atom-Focused Approach, by Gilbert, Kirss, and Foster

a. ***other supplemental materials:*** Lab Manuals

5. Specific course information

a. catalog description: Descriptive and theoretical chemistry

b. prerequisites: C- or better in MATH 120G

c. required, elective, or selected elective: This course is required for Engineering Physics majors with the Aerospace, Electrical and Mechanical Concentrations.

6. Specific goals for the course

a. The student will: • demonstrate knowledge of basic chemical principles, including the following areas: structure of the atoms and nature of electrons, periodicity of atomic properties, ionic vs. covalent bonds and the compounds containing them, molecular structure, geometry, properties, stoichiometry, reaction energetics, solutions, types of reactions; • see applicability of chemistry to common occurrences in daily life; • analyze a problem and determine the appropriate mathematical manipulation to solve it; • blend macroscopic phenomena with microscopic understanding; • experience scientific inquiry through chemistry; • construct hypotheses and design the verification in their laboratory experiments; and • hone scientific communication skills with lab reports that reflect their quantitative analyses.

b. *This course does not provide a measure for Student Outcomes (a)-(k)*

7. Brief list of topics to be covered

- A molecular view
- Chemical Bonding
- Bonding Theories
- Intermolecular Forces
- Stoichiometry
- Aqueous Solutions

CHEM 115G. Principles of Chemistry I (4)

1. Course number and name: CHEM 115G. Principles of Chemistry I

2. Credits and contact hours: 4 credit hours (3 credit hours for lecture, 1 credit hour for lab)

3. Instructor's or course coordinator's name: Feifei Li

4. Text book, title, author, and year

- Chemistry: The Central Science, 13/E by Brown, Nelson & Kemp

a. ***other supplemental materials:*** none

5. Specific course information

a. catalog description: Detailed introduction to analytical, inorganic and physical aspects of chemistry; both descriptive and theoretical explanations. Structured for chemistry and biochemistry majors but appropriate for other physical and life science students.

b. prerequisites: Eligible to take MATH 190G and ACT composite score of ^{3}22; co-requisites: none

c. required, elective, or selected elective: This course is required for Engineering Physics majors with the Chemical Concentration.

6. Specific goals for the course

a. The student will: • understand relationship that exists between physical and chemical properties in matter; • develop skills to solve chemical problems in qualitative and quantitative manners; • be provided a molecular world view, an outlook unique to chemistry and essential to an educated person; and • be prepared for subsequent high level chemistry courses.

b. *This course does not provide a measure for Student Outcomes (a)-(k)*

7. Brief list of topics to be covered

- Matter and Measurement
- Moles
- Atomic Weights & the Periodic Table
- Compounds • Chemical Reactions
- Calculations based on a balanced chemical equation
- Limiting Reactants • Oxidation-reduction
- Electrolyte
- Acids and Bases
- Precipitation
- Calculation of molarity
- Basic thermochemistry
- Enthalpy of reaction and Hess's law
- Calorimetry; Enthalpy of formation
- Atomic orbitals
- Electron Configuration
- Bohr Model
- Periodic Trends
- Metals and non Metals
- Basic concepts of Chemical bonding
- Drawing Lewis structures
- Extend Octet. Bond Enthalpy
- Polarity
- Valence Bond Theory
- MO Theory

CHEM 116G. Principles of Chemistry II (4)

1. Course number and name: CHEM 116G. Principles of Chemistry II

2. Credits and contact hours: 4 credit hours (3 credit hours for lecture, 1 credit hour for lab)

3. Instructor's or course coordinator's name: William Quintana

4. Text book, title, author, and year

- CHEMISTRY: The Central Science, 13th Edition, by Brown, Lemay, Bursten, Murphy and Woodward, Pearson/Prentice Hall
- Laboratory Experiments for CHEMISTRY: The Central Science, by Nelson and Kemp,

a. ***other supplemental materials:*** none

5. Specific course information

a. ***catalog description:*** Recommended for chemistry majors and other qualified students.

b. ***prerequisites:*** CHEM 115; co-requisites: none

c. ***required, elective, or selected elective:*** This course is required for Engineering Physics majors with the Chemical Concentration.

6. Specific goals for the course

a. The student will: • understand basic chemical principles in important aspects of chemistry, such as matter, atoms, molecules and ions, stoichiometry, thermochemistry, chemical equilibrium (gas phase, acid–base, solubility), intermolecular forces, and electrochemistry; • understand the qualitative and quantitative aspects important to chemistry. • establish a firm foundation in chemical concepts that will be explored further in higher-level courses that are part of an undergraduate education; and • develop a molecular view of chemistry, unique to this particular branch of science

b. *This course does not provide a measure for Student Outcomes (a)-(k)*

7. Brief list of topics to be covered

• Molecular Geometry and Bonding Theories

• Gases

• Liquids and Intermolecular Forces.

• Properties of Solutions

• Chemical Kinetics

• Chemical Equilibrium

• Acid – Base Equilibria

• Aqueous Equilibria

• Chemical Thermodynamics

• Electrochemistry

• Nuclear Chemistry

CHEM 313. Organic Chemistry (3)

1. Course number and name: CHEM 313. Organic Chemistry I

2. Credits and contact hours: 3 credit hours = 45 contact hours per semester

3. Instructor's or course coordinator's name: James Herndon

4. Text book, title, author, and year

- Organic Chemistry, 8th ed., by Carey and Giuliano (ISBN #978-0-07-340261-1)

a. other supplemental materials: none

5. Specific course information

a. catalog description: Nomenclature, uses, basic reactions, and preparation methods of the most important classes of aliphatic and aromatic compounds.

b. prerequisites: CHEM 112G or 116; co-requisites: none

c. required, elective, or selected elective: This course is required for Engineering Physics majors with the Chemical Concentration.

6. Specific goals for the course

a. The student will acquire a fundamental understanding of the reactivity and physical properties of organic molecules after completing CHEM 313/314. A graduate of this course should be capable of looking at a chemical structure and be able to predict reactivity, acid-base behavior, stability, solubility, possible precursor compounds, and spectral properties from the molecular structure alone.

b. *This course does not provide a measure for Student Outcomes (a)-(k)*

7. Brief list of topics to be covered

- Structure and Properties
- Alkanes and Cycloalkanes
- Cis-trans stereoisomers
- Chirality
- Alcohols and Alkyl Halides
- Nucleophilic Substitution
- Alkenes – Elimination reactions
- Alkynes
- Free Radicals
- Conjugation in Alkadiene & Allylic systems
- Arenes and Aromaticity

COMM 265G. Oral Communications Elective (3)

1. Course number and name: Communication 265G: Principles of Human Communication

2. Credits and contact hours: 3 credit hours = 45 contact hours per semester

3. Instructor's or course coordinator's name: Team Taught by Greg Armfield and Danielle Halliwell

4. Text book, title, author, and year

- Armfield. G. G. & Morgan, E.L. (Eds.). (2016). Human Communication in Action. (6th Ed.) Dubuque, IA: Kendall/Hunt. ISBN: 978-1-4652-9729-7.

a. ***other supplemental materials:*** none

5. Specific course information

a. catalog description: COMM 265G is an introduction to the study of human communication. You will learn how communication functions in a variety of situations and settings. COMM 265G combines both the theory and practice of communication. This means we will study many of the communicative actions that you already do, while understanding the communication truths (habits, patterns) that you can reform and improve the way you interact with others. The topics we will cover are public speaking, nonverbal communication, interpersonal communication, intercultural communication, organizational communication, communication and technology, small group communication, and leadership and communication.

b. prerequisites: none; co-requisites: none

c. required, elective, or selected elective: This course is required for all Engineering Physics majors.

6. Specific goals for the course

a. COMM 265G is a general education course and complies with the general education philosophy and objectives of New Mexico State University and with the State Common Core Competencies. Thus, upon completion of the course, each student should be able to do the following: • Develop strategies for reducing communication anxiety and for building confidence while communicating with others. • Express a primary purpose in a compelling statement and order supporting points logically and convincingly. • Analyze and evaluate oral and written communication in terms of situation, audience, purpose, and culturally diverse points of view. • Use effective rhetorical strategies to persuade, inform, and entertain. • Integrate research correctly and ethically from credible sources to support the primary purpose of communication. • Engage in reasoned civic discourse while recognizing the distinctions among opinions, facts, and inferences.

b. *This course does not provide a measure for Student Outcomes (a)-(k)*

7. Brief list of topics to be covered

- An Introduction and Principles
- Apprehension, Speech Making
- Public Speaking
- Organization, Outlining, Audience Analysis, and Supporting Material

• Informative Speeches
• Interpersonal Communication
• IPC and Relationships
• Conflict
• Relationships and Conflict
• Introduction to Culture Communication: Narratives and Rituals
• Cultural Adaptation
• Organizational Comm. •
Impromptu Speech
• Persuasive Speech
• Credibility
• Emotion
• Persuasion
• Nonverbal
• Leadership
• Comm. Technology
• Common Myths

ENGL 111G. Rhetoric and Composition (4)

1. Course number and name: ENGL 111G. Rhetoric and Composition

2. Credits and contact hours: 4 credit hours = 60 contact hours per semester

3. Instructor's or course coordinator's name: various instructors from the Department of English

4. Text book, title, author, and year

- Habits of the Creative Mind, Paideia 16, and Readings for Writers come as a bundled set. • Graff, Gerald and Cathy Birkenstein, They Say, I Say: The Moves That Matter in Academic Writing, 3rd ed, WWW Norton, 2014.
- Miller, Richard E. and Ann Jurecic, Habits of the Creative Mind, Bedford/St. Martin's, 2016. • Al-Khateeb, Mais T., Felicita Arzu Carmichael, Kefaya Diab, Dylan Retzinger, Kellie Sharp-Hoskins, and Kelly A. Whitney, Paideia 16: Research, Writing, and Argument in English 111 at New Mexico State University. Hayden-McNeil, 2016.
- New Mexico State University, Readings for Writers, Bedford/St. Martin's, 2015.

a. other supplemental materials Jump drive or other electronic storage device for backing up and storing assignments.

5. Specific course information

a. catalog description: Skills and methods used in writing university-level essays.

b. prerequisites ACT standard score in English of 16 or higher or a Compass score 76 or higher; for those scoring 13-15 in English on the ACT or 35-75 on the Compass, successful completion of a developmental writing course; for those scoring 12 or below on the ACT standard score in English or 34 or below on the Compass, successful completion of two developmental writing courses. co-requisites: none

c. required, elective, or selected elective: This course is required for all Engineering Physics majors.

6. Specific goals for the course

a. The student will: • Practice writing processes, from invention, drafting, and revising to editing and polishing. • Read actively and think critically. • Use writing to persuade, inform, and engage an audience. • Explore new methods of academic inquiry, rhetorical analysis, and documentation. • Develop academic research abilities. • Analyze and evaluate oral and written communication in terms of situation, audience, purpose, aesthetics, and adverse points of view. • Express a primary purpose in a compelling statement and order supporting points logically and convincingly. • Use effective rhetorical strategies to persuade, inform, and engage. • Employ writing and/or speaking processes such as planning, collaborating, organizing, composing, revising, and editing to create presentations using correct diction, syntax, grammar, mechanics. • Integrate research correctly and ethically from credible sources to support the primary purpose of communication. • Engage in reasoned civic discourse while recognizing the distinctions among opinions, facts, and inferences.

b. *This course does not provide a measure for Student Outcomes (a)-(k)*

7. Brief list of topics to be covered

- UNIT 1 – Inquiry into self and your linguistic experiences o Language and literacy – relationship to home and language o Looking back on your linguistic identities o How do linguistic and cultural experiences affect your ideas about what it means to write in college?
- UNIT 2 – Inquiry into mindful critical reading o What does it mean to read mindfully and critically? o Grappling with difficult and critical texts when you write o Embedding other authors' words and ideas within your texts
- UNIT 3 – Inquiry into community research o What is research? o Exploring primary sources and local resources o Researching an issue in your hometown, on campus, or in another close community o Working with the NMSU library's Research Diaries o Citing and acknowledging outside texts
- UNIT 4 – Inquiry into broader conversations: public, political, and social concerns o What is research (again, we ask)? o Finding a topic of inquiry: What is your relationship as a researcher to the subject? o Exploring secondary sources in print and digital spaces o Inquiring and interpreting o Writing it up and reaching a conclusion o Creating a bibliography
- UNIT 5 – Reflection on inquiry: writing in college and beyond

ENGL 218G. Technical and Scientific Communication (3)

1. Course number and name: ENGL 218G. Technical and Scientific Communication

2. Credits and contact hours: 3 credit hours = 45 contact hours per semester

3. Instructor's or course coordinator's name: various instructors from the Department of English

4. Text book, title, author, and year

- Johnson-Sheehan, Richard. (2011). Technical Communication Strategies for Today. New York: Longman.
- Howard, Rebecca Moore. (2014). Writing Matters. (Special ed.). Boston: McGraw Hill.

a. other supplemental materials none

5. Specific course information

a. catalog description: Effective writing for courses and careers in sciences, engineering, and agriculture. Strategies for understanding and presenting technical information for various purposes to various audiences.

b. prerequisites: ENGL 111G or SPCD 111G or ENGL 111M; co-requisites: none

c. required, elective, or selected elective: This course is required for all Engineering Physics majors.

6. Specific goals for the course

a. The student will… • Describe the difference between technical communication and other forms of writing • Identify and describe documents used in technical communication, including memos, letters, emails, reports, proposals, and instruction manuals • Demonstrate the ability to analyze a rhetorical situation and develop appropriate documents in response • Identify and analyze target audiences • Understand and use basic principles of document design • Demonstrate familiarity with the computer-assisted writing process • Demonstrate the ability to manage information effectively and use it appropriately • Correctly use technical and scientific documentation styles • Present information in a coherent, logical manner, both in spoken and written form Course goals: • To understand the genre and manipulate the structure of selected technical documents; • To convey clearly, cogently and correctly through written media, the technical aspects of a practice to non-specialist audience; • To recognize and use the rhetorical and stylistic elements necessary for the successful practice of scientific and technical communication; • To work collaboratively and individually to research, to analyze, and to write about, public debates regarding the conduct of science and technology; • To appreciate your obligations as prospective practitioners in your chosen field to laypersons affected by your work.

b. *This course does not provide a measure for Student Outcomes (a)-(k)*

7. Brief list of topics to be covered

Through reading and writing, and online discussions/workshop exercises, the student will become familiar with effective writing for courses and careers in the sciences, engineering, and agriculture and develop strategies for understanding and presenting technical information for various purposes to various audiences.

ENGR 100. Introduction to Engineering (3)

1. Course number and name: ENGR 100. Introduction to Engineering

2. Credits and contact hours: 3 credit hours (2+3P) = 75 contact hours per semester

3. Instructor's or course coordinator's name: John Tapia

4. Text book, title, author, and year

- Engineering Fundamentals: An Introduction to Engineering, 5th ed., S. Moaveni, Cengage (2016).

a. other supplemental materials - none

5. Specific course information

a. catalog description: An introduction to the various engineering disciplines, the engineering approach to problem solving, and the design process. Projects emphasize the importance of teamwork, written & oral communication skills, as well as ethical responsibilities.

b. prerequisites: Placement in MATH 121 or better; co-requisites: ENGL 111

c. required, elective, or selected elective: This course is required for all Engineering Physics majors.

6. Specific goals for the course

a. The student will… • have a social and professional network of peers; • have a solid curriculum plan for each semester including summers; • have a desire to pursue extra-curricular activities related to engineering; • engage in critical thinking and the design process while learning important team building skills and ethical approaches to problem solving; • gain appreciation for, and skills for effective communication, teamwork, and ethics; • become familiarized with the engineering profession; • gain a knowledge of and skills in Microsoft Excel; • gain a knowledge of and skills in MATLAB; • use other tools such as drawing software, mathematics, economics, etc.; and • gain knowledge of dimensions, length, time, mass, force, temperature, electric current, energy and power, and related parameters in engineering.

b. ENGR 100 addresses Student Outcomes (a), (d), (e), (f), (g), (h), (i), (j), and (k).

7. Brief list of topics to be covered

- see 6. Goals above

MATH 191G. Calculus and Analytic Geometry I (4)

1. Course number and name: MATH 191G. Calculus and Analytic Geometry I

2. Credits and contact hours: 4 credit hours = 60 contact hours per semester

3. Instructor's or course coordinator's name: Mary Ballyk

4. Text book, title, author, and year

- Calculus, Early Transcendentals, Third Edition by Jon Rogawski and Colin Adams. Publisher: W. H. Freeman; 3 edition (January 15, 2015)

a. ***other supplemental materials*** none

5. Specific course information

a. catalog description: Limits and continuity, theory and computation of derivatives, applications of derivatives, extreme values, critical points, derivative tests, L'Hopital's Rule.

b. prerequisites: MATH 190 with C- or better; co-requisites: none

c. required, elective, or selected elective: This course is required for all Engineering Physics majors.

6. Specific goals for the course

a. The goals are to present the concepts of calculus, to stress techniques, applications, and problem solving, and to emphasize numerical aspects such as approximations and order of magnitude. Overall, the goals are to illustrate the power of calculus as a tool for modeling situations arising in physics, science, engineering and other fields

b. *This course does not provide a measure for Student Outcomes (a)-(k)*

7. Brief list of topics to be covered

- Rates of change • tangent lines
- limits
- Limit laws
- Continuity
- methods to evaluate limits
- Trig limits
- limits at infinity
- Intermediate Value Theorem
- Definition of the derivative
- derivatives as functions
- product and quotient rules
- Rates of change, higher derivatives
- The chain rule
- implicit differentiation
- derivatives of exponential and log
- functions, related rates
- L'Hopital's rule
- Linear approximations
- extreme values.
- The mean value theorem
- shapes of graphs
- Graph sketching
- Max/min problems

MATH 192G. Calculus II (4)

1. Course number and name: MATH 192G. Calculus II

2. Credits and contact hours: 4 credit hours = 60 contact hours per semester

3. Instructor's or course coordinator's name: Amal Mostafa

4. Text book, title, author, and year

- Calculus, Early Transcendentals, Third Edition by Jon Rogawski and Colin Adams. Publisher: W. H. Freeman; 3 edition (January 15, 2015)

a. other supplemental materials none

5. Specific course information

a. catalog description: Riemann sums, the definite integral, antiderivatives, fundamental theorems, techniques of integration, applications of integrals, improper integrals, Taylor polynomials, sequences and series, power series and Taylor series.

b. prerequisites: C or better in MATH 191; co-requisites: none

c. required, elective, or selected elective: This course is required for all Engineering Physics majors.6.

Specific goals for the course

a. The goals are to present the concepts of calculus, to stress techniques, applications, and problem solving. Overall, the goals are to illustrate the power of calculus as a tool for modeling situations arising in physics, science, engineering and other fields.

b. *This course does not provide a measure for Student Outcomes (a)-(k)*

7. Brief list of topics to be covered

- Definite and indefinite integrals
- Fundamental theorem of calculus
- Total & net change, substitution, transcendental functions
- Applications of integrals
- Volumes, volumes of revolution, shells
- Work and energy
- integration by parts
- trigonometric integrals
- trigonometric substitutions
- Improper integrals
- numerical integration
- Taylor polynomials
- Sequences
- infinite series
- Convergence tests
- power series
- Taylor series

MATH 291. Calculus and Analytic Geometry III (3)

1. Course number and name:MATH 291. Calculus and Analytic Geometry III

2. Credits and contact hours: 3 credit hours = 45 contact hours per semester

3. Instructor's or course coordinator's name: Chris Stuart

4. Text book, title, author, and year

- Calculus, Early Transcendentals, Third Edition by Jon Rogawski and Colin Adams. Publisher: W. H. Freeman; 3 edition (January 15, 2015)

a. ***other supplemental materials*** none

5. Specific course information

a. catalog description: Vector algebra, directional derivatives, approximation, max-min problems, multiple integrals, applications, cylindrical and spherical coordinates, change of variables.

b. prerequisites: C or better in MATH 192G; co-requisites: none

c. required, elective, or selected elective: This course is required for all Engineering Physics majors.

6. Specific goals for the course

a. The goals are to present the concepts of calculus, to stress techniques, applications, and problem solving, and to emphasize numerical aspects such as approximations and order of magnitude. Overall, the goals are to illustrate the power of calculus as a tool for modeling situations arising in physics, science, engineering and other fields.

b. *This course does not provide a measure for Student Outcomes (a)-(k)*

7. Brief list of topics to be covered

- Vectors in the Plane
- Vectors in Three Dimensions
- Dot Product and the Angle Between Two Vectors
- The Cross Product
- Planes in Three-Space
- A Survey of Quadric Surfaces
- Cylindrical and Spherical Coordinates
- Vector-Valued Functions
- Calculus of Vector-Valued Functions
- Arc Length and Curvature
- Motion in Three-Space
- Planetary Motion According to Kepler and Newton
- Functions of Two or More Variables
- Limits and Continuity in Several Variables
- Partial Derivatives
- Differentiability and Tangent Planes
- The Gradient and Directional Derivatives
- The Chain Rule
- Optimization in Several Variables
- Integration in Two Variables
- Double Integrals over More General Regions
- Triple Integrals
- Integration in Polar, Cylindrical, and Spherical Coordinates
- Applications of Multiple Integral

MATH 392. Differential Equations (3)

1. Course number and name: MATH 392. Differential Equations

2. Credits and contact hours: 3 credit hours = 45 contact hours per semester

3. Instructor's or course coordinator's name: Dante DeBlassie

4. Text book, title, author, and year

- Differential Equations (Classic Version), Second Edition by J. Polking, A. Boggess and D. Arnold, Pearson, 2018. ISBN 9780134689586.

a. other supplemental materials: none

5. Specific course information

a. catalog description: Introduction to differential equations and dynamical systems with emphasis on modeling and applications. Basic analytic, qualitative and numerical methods. Equilibria and bifurcations. Linear systems with matrix methods, real and complex solutions.

b. prerequisites: C− or better in MATH 192G or B or better in MATH 236; co-requisites: none

c. required, elective, or selected elective: This course is required for all Engineering Physics majors.

6. Specific goals for the course

a. The student will be capable of applying the mathematical concepts described.

b. *This course does not provide a measure for Student Outcomes (a)-(k)*

7. Brief list of topics to be covered

- First-order differential equations, modeling and applications
- Second-order differential equations
- The Laplace Transform
- Numerical Methods
- Matrix Algebra
- Linear Systems with constant coefficients
- Nonlinear Systems
- Series solutions
- Fourier Series
- Partial Differential Equations

Appendix B: Faculty Vitae

Engineering Physics

Bachelor of Science in Engineering Physics

Self-Study Report

New Mexico State University

Engineering Physics Program

(Bachelor of Science in Engineering Physics)

at

New Mexico State University

Tenured & Tenure-Track Faculty, Regularized College Faculty and Instructional Staff – Department of Physics

Matthias Burkardt

Education – degree, discipline, institution, year

- Habilitation Physics, 1995. *Universität Erlangen-Nurnberg, Germany*
- Ph.D. Physics, 1989. *Universität Erlangen-Nurnberg, Germany*
- Diploma Physics, 1987. *Universität Erlangen-Nurnberg, Germany*

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- *New Mexico State University*, Department of Physics, Las Cruces, NM: Distinguished Achievement Professor, May 2012 – present, full time
- Full Professor, August 2004 – May 2012, full time
- Associate Professor, August 1999 – August 2004, full time
- Assistant Professor, August 1995 - August 1999; full-time

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- *Thomas Jefferson National Accelerator Facility,* Newport News, VA: Visiting Scientist, August 2008 – May 2009, full-time
- *University of Maryland,* College Park, MD: Visiting Scientist, April 2002 – May 2002, full-time
- *Center for the Subatomic Structure of Matter,* Adelaide, Australia: Visiting Scientist, March 2002, full-time
- *University of Melbourne,* Australia: Visiting Scientist, January 2002 – February 2002, full-time
- *Technische Universitat München,* Munich, Germany: Visiting Scientist, August 2001 – December 2001, full-time
- Stanford Linear Accelerator Center, Stanford, CA: Postdoctoral Research Associate, January 1990 – August 1991, full-time
- *Massachusetts Institute of Technology,* Cambridge, MA: Postdoctoral Research Associate, August 1991 – August 1993, full-time
- *National Institute for Nuclear Theory and University of Washington,* Seattle, WA: Junior Fellow and Research Assistant Professor, August 1993 – August 1995, full-time

Certifications or professional registrations

- none

Current membership in professional organizations

- American Physical Society

Honors and awards

- NMSU College of Arts & Sciences Faculty Outstanding Achievement Award in Teaching, 2014
- *Outstanding Achievement Professor, NMSU* May 2012
- *College of Arts & Sciences Faculty Outstanding Achievement Award in Scholarship,* NMSU, October 2007
- *New Mexico State University Westhafer Award, NMSU* May 2006

- *Fellow of the American Physical Society (APS)*, November 2004
- *Gardiner Professorship*, New Mexico State University (NMSU), Department of Physics, 2001-2003
- *Invitation Fellowship*, Japanese Society for the promotion of Sciences (JSPS), 1999 and 2001
- *Von Lynen Fellowship*, Alexander von Humboldt Foundation, 1990-1992

Service activities (within and outside of the institution)

- Chair of the NMSU-Physics Tenure & Promotion Committee, since 2018

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Burkardt, M. R., Alhalholy, T. (2017). Quark-Photon-Quark Correlation and Transverse Target Single Spin Asymmetry in Inclusive DIS. Physical Review, D96, 016025-016028
- Burkardt, M. R. (2017). GPDs and Orbital Angular Momentum. Few Body Sys., 58
- Burkardt, M. R., Adhikari, L. (2016). Angular Momentum Distribution in the Transverse Plane. Physical Review, D94, 114021
- Abdallah, M., Burkardt, M. (2016). Transverse Force on Transversely Polarized Quarks in Longitudinally Polarized Nucleons. Phys. Rev., D94, 094040
- Burkardt, M. R. (2016). Inclusive Single-Spin Asymmetries, Quark-Photon, and Quark-Quark Correlations. Physical Review, D96, 094016-094-020
- Burkardt, M. R., Chabysheva, S., Hiller, J. (2016). Two-dimensional light-front $\phi 4$ theory in a symmetric polynomial basis. Phys. Rev., D94, 065006
- Burkardt, M. R. Inclusive Single-Spin Asymmetries, Quark-Photon, and Quark-Quark Correlations. Phys. Rev., D94, 094016
- Bignell, R., Leinweber, D., Kamleeh, W., Burkardt, M. R. (2017). Nucleon Magnetic Properties from Lattice QCD with the Background Field Method. PoS, INPC2016, 8
- Burkardt, M. R. (2017). GPDs and Orbital Angular Momentum. PoS, QCDEV2016, 10

Briefly list the most recent professional development activities

- n.a.

Michaela Burkardt

Education – degree, discipline, institution, year

- Ph. D., Physics, Universität Erlangen-Nürnberg, Germany, 1992
- Diploma Physics, Universität Erlangen-Nürnberg, Germany, 1987
- Graduate Certificate of Online Teaching and Learning, New Mexico State University, NM, 2008

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State University (NMSU), Department of Physics, Full College Professor, 2014 – present, part time
- NMSU, Department of Physics, College Associate Professor, 2007 – 2014, part time
- NMSU, Department of Physics, College Assistant Professor, 2002 – 2007, part time
- Northeastern University, Department of Physics, Clinical Lecturer, 1992-1993, part time
- NMSU, College of Arts and Sciences, Program Director, Peer Learning Assistants Program, 2016 (Apr-Dec), part-time
- NMSU, College of Arts and Sciences, Program Coordinator, Peer Learning Assistants Program, 2014-2016, part-time
- NMSU, Teaching Academy, Faculty Developer/Project Coordinator II, PRIMOS Grant, 2009-2010, full time (Nov 2008-Dec 2008, part time)

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- n.a.

Certifications or professional registrations

- n.a.

Current membership in professional organizations

- American Physical Society (4-Corners Section, Topical Group on Physics Education Research, Forum on Education)
- American Association of Physics Teachers

Honors and awards

- NMSU College of Arts & Sciences Faculty Outstanding Achievement Award in Teaching, 2014
- NMSU College of Arts & Sciences Outstanding College Faculty Award, 2012
- NMSU College of Arts & Sciences Faculty Outstanding Achievement Award, 2007

Service activities (within and outside of the institution)

- NMSU Faculty Senator, College-Track, since 2017
- Teaching Academy Fellow, NMSU, since 2016 (Offered a short course "Teaching and Learning STEM" Jan-Mar, 2017)
- Consultant for the "Class Visitation" Program of the Teaching Academy, NMSU, since 2011
- Promotion & Tenure Committee of NMSU's Biology Department for College Track Faculty, 2015-2016, since 2017

- Promotion & Tenure Committee of NMSU's English Department for College Track Faculty, 2014
- Member of the Osteopathic Medicine Pathway Program Admissions Committee, since 2016
- Member of the Scholarship Committee, Department of Physics, NMSU, since 2011
- Chair of Tutoring Services, Department of Physics, NMSU, since 2010
- Director/Coordinator Supplemental Instruction, Department of Physics, NMSU, since 2012
- Faculty Mentor, "Preparing Future Faculty", since 2017
- Member of the Recruiting/Retention Committee, Department of Physics, NMSU, 2010-2016
- Faculty Co-Advisor of Society of Physics Students (SPS), Department of Physics, NMSU, 2011-2016

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- *Poster:* Burkardt, M., Adding UG Peer Learning Assistants to your Course Team, 2016 Summit for Transforming STEM Teaching in Higher Education, Boise State University, Boise, Idaho, April 14-15, 2016

Briefly list the most recent professional development activities

- "2016 Summit for Transforming STEM Teaching in Higher Education", Boise State University, Boise, Idaho, April 14-15, 2016
- Teaching Academy, NMSU, Member 2016/2017 (>10 hours), Sustaining Member 2016, (>38 hours), Member 2015, Member 2013/2014, Distinguished Member (>40 hours) 2012/2013, 2011/2012
  Exemplary activities:
  - "Want Your Students to Learn More? Designing Your Courses for More Significant Learning", by Dee Fink, Jan 2016, (7.5 hours)
  - "Teaching in NMSU's First TEAL Classroom", by Michele Shuster, Oct 2015 (5 hours)
  - "What the Best College Teachers Do", Workshop by Ken Bain, followed with Book Club, Feb –Mar 2013
- Attendee and session chair at the annual 4-Corners Section meeting of the American Physical Society (2016)
- "Strategic Programs for Innovations in Undergraduate Physics" (Spin-UP), Austin, TX, May 2012

Robert Cooper

Education – degree, discipline, institution, year

- Ph.D., Physics, University of Michigan, Ann Arbor, MI, 2008
- M.S., Physics, University of Michigan, Ann Arbor, MI, 2005
- B.S., Physics, University of Toledo, Toledo, OH, 2002
- B.S., Mathematics, University of Toledo, Toledo, OH, 2002

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State University (NMSU), Department of Physics, Assistant Professor, 2015 – present, full time

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Sandia National Laboratories, Senior Member of the Technical Staff, 2009-2011, full time
- Indiana University, Department of Physics, Center for Exploration of Energy and Matter, Postdoctoral Scholar, 2011-2015, full time
- Stanford University, Department of Physics, Postdoctoral Scholar, 2008-2009, full time

Certifications or professional registrations

- n.a.

Current membership in professional organizations

- American Physical Society (APS) in Division of Particles and Fields (DPF), Division of Nuclear Physics (DNP), 4-Corners Section (4-C)

Honors and awards

- Faculty Travel Grant for travel to NUFACT in Uppsala, Sweden, New Mexico State University (NMSU), 2017
- MiniGrant for development of low-cost FPGA electronics, NMSU, 2015
- U.S. Patent 8,338,975. *Method for Improving the Angular Resolution of a Neutron Scatter Camera*, Sandia National Laboratories, 2012

Service activities (within and outside of the institution)

- Recruitment Committee, met with students at APS DNP and APS 4-C section meetings as well as meet with prospective students, 2015-present
- Grand Awards Judge in Physics, Intel International Science and Engineering Fair (ISEF), 2016-present
- Advisory Board and Judge, Northwest Ohio Science and Engineering Fair (NWOSEF), 1999-present
- Reviewer, Department of Energy (DOE) Office of Science Graduate Student Research (SCGSR), 2016
- Question Writer, Oak Ridge Associated Universities (ORAU) National Science Bowl (NSB), 2017

- Abstract Reviewer, American Physical Society (APS) Division of Nuclear Physics (DNP) Conference Experiences for Undergraduates (CEU), 2017

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- D. Akimov, et al. [COHERENT collaboration], "Observation of Coherent Elastic Neutrino-Nucleus Scattering." *Science* **357**, 1123 (2017).
- A.A. Aguilar-Arevalo, et al. [MiniBooNE-DM collaboration], "Dark Matter Search in Proton Beam Dump with MiniBooNE." *Physical Review Letters* **118**, 221803 (2017).
- M.J. Bales, R. Alarcon, C.D. Bass, E.J. Beise, H. Breuer, J. Byrne, T.E. Chupp, K.J. Coakley, R.L. Cooper, M.S. Dewey, S. Gardner, T.R. Gentile, D. He, H.P. Mumm, J.S. Nico, B. O'Neill, A.K. Thompson, F.E. Wietfeldt, "Precision Measurement of the Radiative β Decay Mode of the Free Neutron." *Physical Review Letters* **116**, 242501 (2016).
- S.J. Brice, R.L. Cooper, F. DeJongh, A. Empl, L.M. Garrison, A. Hime, E. Hungerford, T. Kobilarcik, B. Loer, C. Mariani, M. Mocko, G. Muhrer, R. Pattie, Z. Pavlovic, E. Ramberg, K. Scholberg, R. Tayloe, R.T. Thornton, J. Yoo, A. Young. "A New Method for Measuring Coherent Elastic Neutrino-Nucleus Scattering at an Off-Axis High-Energy Neutrino Beam Target." *Physical Review* **D 89**, 072004 (2014).
- T.E. Chupp, R.L. Cooper, K.P. Coulter, S.J. Freedman, B.K. Fujikawa, A. Garcia, G.L. Jones, H.P. Mumm, J.S. Nico, A.K. Thompson, C.A. Trull, F.E. Wietfeldt, and J.F. Wilkerson. "Search for a T-Odd, P-Even Triple Correlation in Neutron Decay." *Physical Review* **C 86**, 035505 (2012).
- Invited Talk, "Dark Matter Search in the MiniBooNE Proton Beam Dump Experiment" at *19th International Workshop on Neutrinos from Accelerators (NUFACT)*, Uppsala University, Uppsala, Sweden, September 26, 2017.
- Invited Talk, "Dark Photon/Dark Matter Measurements with CEvNS Detectors" at *New Extensions of Coherent scattering and other Lepton Interactions for new Physics SEarches (νECLIPSE),* University of Tennessee, Knoxville, TN, August 22, 2017.
- Invited Talk, "Current and Future Results from MiniBooNE-DM" at *U.S. Cosmic Visions: New Ideas in Dark Matter*, University of Maryland, College Park, MD, March 23, 2017
- Invited Talk, "The CAPTAIN Low-Energy Physics Program" at *11th International Workshop on Neutrino-Nucleus Scattering in the Few-GeV Region (NuInt17)*, University of Toronto, Toronto, Ontario, June 30, 2017.
- Invited Talk "SBN Future" at *Dark Sectors Workshop*, SLAC National Accelerator Laboratory, Stanford, CA, April 28, 2016.

Briefly list the most recent professional development activities

- Attendee and participant at the annual 4-Corners Section meetings of the American Physical Society, 2016-present
- Attendee and participant at the annual APS Division of Nuclear Physics meeting, 2011-present
- Participant at Brookhaven National Laboratory Cold Electronics Mini-Summer School, Brookhaven, NY, July 18-21, 2016

Francisco J. Carreto-Parra

Education – degree, discipline, institution, year

- M.S., Physics, University of Texas at El Paso, USA, 2007
- B.S. E., Physics Engineering, Universidad Autónoma Metropolitana, Mexico, 2003

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- El Paso Community College (EPCC), Department of Physics, Instructor, 2008- present, part time
- Doña Ana Community College (DACC), Department of Science, Instructor, 2015-2017, part time
- EPCC, HIS STEM Architecture grant, Coordinator of Tutors and Physics Tutor, 2013-2014, Full time.
- University of Texas at El Paso (UTEP), Physics Department, Instructor, 2010-2013, part time
- UTEP, Professional & Public Programs, Instructor of Science, 2008-2010, part time
- UTEP, Physics Department, Teaching Assistant, 2005-2007, part time
- Universidad Autónoma Metropolitana, Engineering Department, Teaching Assistant, 1998-2001, part time

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Medical Sterilizer's Service, Owner and Technician, 2002 – 2004, part time
- Clínica Universal, Maintenance responsible, 2000-2004, part time

Certifications or professional registrations

- Mexican Cedula as Physics Engineer.

Current membership in professional organizations

- n.a.

Honors and awards

- Twice Nominated, 2016 and 2011, for El Paso Community College Adjunct Faculty Award

Service activities (within and outside of the institution)

- Founder and Coordinator of program "Astronomy Observatory at EPCC" with Service Learning Program of EPCC, 2009-2013, 2016.
- Guest Speaker at Museum of Archaeology, El Paso Tx, 2013-2014
- Guest Speaker at Hueco Tanks State Historic Site, El Paso, Tx, 2009-2016
- Special Guest for Astronomical Outreach. Univision Channel 26-KINT 26 Television, Program "Nuestra Frontera". May 19^{th} 2012.
- Speaker and technician invited, Universidad de Sonora, Mexico, 2003-2006
- Co-Founder of Federación Astronómica Mexicana (FEDAM), Mexico. 2001-2002

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Villicaña-Pedraza, I., Carreto-Parra, F., Carramiñana, A., Saucedo-Morales, J. (2017). Multifrequency Study of the Blazar 3C 454.3

Briefly list the most recent professional development activities

- I am doing corrections, as coauthor, of a couple of peer reviews articles accepted for *The Astrophysical Journal* and *Revista Mexicana de Astronomia y Astrofisica*.

Michael DeAntonio

Education – degree, discipline, institution, year

- Ph. D., Physics, New Mexico State University, Las Cruces, NM 1993
- M.E., Physics, New Mexico State University, Las Cruces, NM 1991
- B.S., Physics, Duquesne University, Pittsburgh PA 1984

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State University (NMSU), Department of Physics, College Professor, 2017 – present, part time
- NMSU, Department of Physics, College Associate Professor, 2007 – 2017, part time
- NMSU, Department of Physics, College Assistant Professor, 2002 – 2007, part time

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- LaSen Inc., Las Cruces, NM: Consulting Engineer, 2005 – 2015, part-time
- Army Research Laboratory, White Sands Missile Range, NM: Scientist/Engineer, 1998-2001, full -time
- Delphi Automotive, El Paso, TX: Applications Engineer, 1996-1998 full -time, full -time
- Texas A&M University, College Station, TX: Visiting Assistant Professor, 1995-1996, full -time
- Army Research Laboratory, White Sands Missile Range, NM: Post-Doctorate Researcher,1993-1995, full -time
- GTE Communication Systems, Albuquerque, NM: Member of Technical Staff, 1985-1988, full -time

Certifications or professional registrations

- n.a.

Current membership in professional organizations

- American Society for Engineering Education (ASEE)
- American Association of Physics Teachers (AAPT)

Honors and awards

- NA

Service activities (within and outside of the institution)

- Physics Assessment Coordinator, 2017-present
- Natural Science Interstate Passport Team , 2016-2017
- Society of Engineering Physicists (SEPh), 2011-present
- Engineering Physics Committee, 2010-present

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- D. Short and M. DeAntonio, "Narrow line width tunable DIAL LIDAR detector," in Renewable Energy and the Environment, OSA Technical Digest (online) (Optical Society of America, November 2013), paper EM2A.5.
- M. DeAntonio and M. Nairat, "Feasibility Study for the Remote Detection of Atmospheric Xenon Using a DIAL LIDAR System," in Imaging and Applied Optics Technical Papers, OSA Technical Digest (online) (Optical Society of America, June 2012), paper RTu1E.5.

Briefly list the most recent professional development activities

- Attendee ABET Symposium (2018)
- Regular attendee and participant at the ASEE annual meetings (2005-2016)
- General Chair for 2015 and regular attendee and participant at the Frontiers in Education Conference (2006-2015)

Michael Engelhardt

Education – degree, discipline, institution, year

- Habilitation, Theoretical Physics, Universität Tübingen, Germany, 2001
- Ph.D., Physics, Universität Erlangen, Germany, 1994
- Diplom, Physics, Universität Erlangen, Germany, 1989

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State University (NMSU), Department of Physics, Associate Professor, 2010 – present, full time
- NMSU, Department of Physics, Assistant Professor, 2004 – 2010, full time
- Universität Tübingen, Germany, Privatdozent (Lecturer), 2002 – 2004, part time
- Universität Tübingen, Germany, Research Associate and Privatdozent (Lecturer), 2001 – 2002, full time
- Universität Tübingen, Germany, DFG Habilitation Fellow, 1999 – 2001, full time
- Universität Tübingen, Germany, Postdoctoral Research Associate, 1996 – 1999, full time
- Universität Erlangen, Germany, Postdoctoral Research Associate, 1996, full time
- Weizmann Institute, Israel, MINERVA Postdoctoral Fellow, 1994 – 1996, full time

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- science+computing ag, Tübingen, Germany, IT Consultant, 2002 – 2004, full time

Certifications or professional registrations

- n.a.

Current membership in professional organizations

- American Physical Society (4-Corners Section, Division of Nuclear Physics)

Honors and awards

- Gardiner Professorship, New Mexico State University (NMSU), Department of Physics, 2017 – 2019
- American Physical Society (APS) Outstanding Referee, 2012

Service activities (within and outside of the institution)

- Interim Graduate Program Head, Department of Physics, NMSU, 2016 – 2017
- Coordinator, Lattice QCD Program, DOE Topical Collaboration on TMDs
- Coordinator and Principal Spokesperson, Lattice TMD Collaboration
- Manuscript Reviews for Physical Review, Journal of High Energy Physics, European Physical Journal, Few Body Systems
- Grant and Fellowship Proposal Reviews for Department of Energy (DOE)

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- J. Green, N. Hasan, S. Meinel, M. Engelhardt, S. Krieg, J. Laeuchli, J. Negele, K. Orginos, A. Pochinsky and S. Syritsyn; Up, down, and strange nucleon axial form factors from lattice QCD, Phys. Rev. D 95 (2017) 114502.
- M. Engelhardt; Quark orbital dynamics in the proton from Lattice QCD – from Ji to Jaffe-Manohar orbital angular momentum, Phys. Rev. D 95 (2017) 094505.
- D. Altarawneh, M. Engelhardt and R. Höllwieser; Model of random center vortex lines in continuous 2+1-dimensional spacetime, Phys. Rev. D 94 (2016) 114506.
- A. Rajan, A. Courtoy, M. Engelhardt and S. Liuti; Parton transverse momentum and orbital angular momentum distributions, Phys. Rev. D 94 (2016) 034041.
- B. Yoon, R. Gupta, T. Bhattacharya, M. Engelhardt, J. Green, B. Joó, H.-W. Lin, J. Negele, K. Orginos, A. Pochinsky, D. Richards, S. Syritsyn and F. Winter; Controlling excited-state contamination in nucleon matrix elements, Phys. Rev. D 93 (2016) 114506.
- M. Engelhardt, P. Hägler, B. Musch, J. Negele and A. Schäfer; Lattice QCD study of the Boer-Mulders effect in a pion, Phys. Rev. D 93 (2016) 054501.
- D. Altarawneh, R. Höllwieser and M. Engelhardt; Confining bond rearrangement in the random center vortex model, Phys. Rev. D 93 (2016) 054007.
- J. Green, S. Meinel, M. Engelhardt, S. Krieg, J. Laeuchli, J. Negele, K. Orginos, A. Pochinsky and S. Syritsyn; High-precision calculation of the strange nucleon electromagnetic form factors, Phys. Rev. D 92 (2015) 031501.
- R. Höllwieser and M. Engelhardt; Approaching SU(2) gauge dynamics with smeared Z(2) vortices, Phys. Rev. D 92 (2015) 034502.
- S. Cisneros, G. Goedecke, C. Beetle and M. Engelhardt; On the Doppler effect for light from orbiting sources in Kerr-type metrics, Mon. Not. Roy. Astr. Soc. 448 (2015) 2733.
- J. Green, J. Negele, A. Pochinsky, S. Syritsyn, M. Engelhardt and S. Krieg; Nucleon electromagnetic form factors from lattice QCD using a nearly physical pion mass, Phys. Rev. D 90 (2014) 074507.
- J. Green, M. Engelhardt, S. Krieg, J. Negele, A. Pochinsky and S. Syritsyn; Nucleon structure from lattice QCD using a nearly physical pion mass, Phys. Lett. B734 (2014) 290.
- M. Engelhardt; Strange quark contributions to nucleon mass and spin from lattice QCD, Phys. Rev. D 86 (2012) 114510.
- J. Green, J. Negele, A. Pochinsky, S. Syritsyn, M. Engelhardt and S. Krieg; Nucleon scalar and tensor charges from lattice QCD with light Wilson quarks, Phys. Rev. D 86 (2012) 114509.
- B. Musch, P. Hägler, M. Engelhardt, J. Negele and A. Schäfer; Sivers and Boer-Mulders observables from lattice QCD, Phys. Rev. D 85 (2012) 094510.

Briefly list the most recent professional development activities

- n.a.

Edwin Fohtung

Education – degree, discipline, institution, year

- Ph.D. Materials Sciences/Physics, 2010. *Universität Freiburg,* Germany
- M.S. Applied Physics, 2007. *Peter the Great St. Petersburg Polytechnic University, Russia*
- B.S. Applied Physics, 2005. *Peter the Great St. Petersburg Polytechnic University, Russia*

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- *New Mexico State University*, Department of Physics, Las Cruces, NM: Assistant Professor, August 2013 – present; full-time
- *Los Alamos National Laboratory*, Experimental Physical Sciences (ADEPS), Los Alamos, NM: LANSCE Assistant Professor/ Visiting Scientist, August 2013 – present; part-time
- *University of California*, San Diego Department of Physics: Postdoctoral Fellow/Associate, November 2010 – August 2013; full-time.
- *Universität Freiburg*: Graduate Research Assistant, 2008 – 2010;

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- *Angstromquelle Karlsruhe (ANKA)- Synchrotron Light Source, Germany*: Wissenschaftler mitarbeiter, 2007 – 2010, full-time

Certifications or professional registrations

- None

Current membership in professional organizations

- Member of the American Physical Society (APS)
- Member of the Materials Research Society (MRS)
- Member of the international society for optics and photonics (SPIE)

Honors and awards

- *Rosen Scholar, Los Alamos National Laboratory, 2014-2017*
- *Bourse d'étude du gouvernement Russe, 2000-2007*
- *Bourses du gouvernement Camerounais, 2001-2007*

Service activities (within and outside of the institution)

- *Grant Reviewer DOD,* Airforce Office of Scientific Research, since 2016.
- *Matter-Radiation Interactions in Extremes (MaRIE)*, Los Alamos National Laboratory Science Review Consulting member, since 2015.
- *Chair*, Oak Ridge National Laboratory, TN Low-Q Science Review Committee, since 2015.
- *Member*, Oak Ridge National Laboratory, TN Low-Q Science Review Committee, 2013-2015.
- *Guest Editor*, Special Issue of Journal of Optics "Coherent Diffractive Imaging", since 2014.
- *Co-chair*, 11th LANSCE School on Mesoscale science, Los Alamos National Laboratory, 2015
- *Chair*, Exchange Bias Session, 58th Annual Conference on Magnetism and Magnetic Material in Denver, November 2015

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- D. Karpov, Z. Liu, T. dos Santos Rolo, R. Harder, P. V. Balachandran, D. Xue, T. Lookman, E. Fohtung, "*Three-dimensional imaging of vortex structure in a ferroelectric nanoparticle driven by an electric field*". Nature Communications 8, Article number: 280 (2017) doi:10 1038/s41467-017-00318-9.
- Zhen Liu, Bin Yang, Wenwu Cao, Edwin Fohtung, and Lookman Turab *"Enhanced energy storage with polar vortices in ferroelectric nanocomposites* ". Phys. Rev. Applied **8**, 034014 (2017).
- Harry M Quiney, Garth Williams, and Edwin Fohtung. "*Editorial: Coherent diffractive imaging". Journal of Optics* (2017);
- S. Adak, M. Hartl, L. Daemen, E. Fohtung, and H. Nakotte. "*Study of oxidation states of the transition metals in a series of Prussian blue analogs using x-ray absorption near edge structure (XANES) spectroscopy*". Journal of Electron Spectroscopy and Related Phenomena;(2016).
- J.W. Kim, A. Ulvestad, S. Manna, R. Harder, E. Fohtung, A. Singer, L. Boucheron, E. E. Fullerton, and O. G. Shpyrko. "*Observation of x-ray radiation pressure effects on nanocrystals*". J. Appl. Phys. 120, 163102 (2016).
- Mahmoud Hammouri, Edwin Fohtung, Igor Vasiliev. "*Ab initio study of magnetoelectric coupling in La0.66Sr0.33MnO3/PbZr0.2Ti0.8O3 multiferroic heterostructures*"; J. Phys. Condensed. Matter 28 396004 (2016).
- J. W. Kim, S. Manna, S. H. Dietze, A. Ulvestard, R. Harder, E. Fohtung, E. Eric Fullerton, and O. G. Shpyrko. "*Curvature-induced and thermal strain in polyhedral gold nanocrystals"*. Appl. Phys. Letts. 105, 173108 (2014).
- Andrew Ulvestard, H. Man Cho, R. Harder, J. W. Kim, E. Fohtung, Y. S. Meng. and O. G. Shpyrko. "*Nanoscale Strain Mapping in Battery Nanostructures*". Applied Phys. Letts. 104 073108 (2014).
- Dmitry Karpov, Tomy dos Santos Rolo, Hannah Rich, Yuriy Kryuchkov, Boris Kiefer and E. Fohtung, "*Birefringent Coherent Diffraction Imaging*". Proc. SPIE 9931, Spintronics IX, 99312F (September 26, 2016); doi:10.1117/12.2235865.

Briefly list the most recent professional development activities

- Annual American Association of Physics Teachers (AAPT) Summer Meeting, College Park, MD, July 25-29, 2015.

Thomas Hearn

Education – degree, discipline, institution, year

- Ph. D., Geophysics, California Institute of Technology, 1985.
- M.S. Geophysics California Institute of Technology, 1981.
- B.S., Physics, University of California, Riverside, 1978.

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State University, Department of Physics, Las Cruces, NM – Associate Professor, September 2008 – present.
- New Mexico State University, Department Head for Physics, August, 2006 to August, 2008.
- New Mexico State University, Department of Physics, Las Cruces, NM - Associate Professor, August, 1996 - present; Assistant Professor, July, 1990 - September, 1996.
- Cornell University, Institute for the Study of the Continents, Ithaca, NY. - Research Associate, Jan, 1989 - June, 1990; Postdoctoral Research Associate, Jan, 1985 - Dec, 1988.

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Rockwell Science Center, Thousand Oaks, CA, Consultant, May 1983 - Jan. 1984
- University of California, Riverside, Institute of Geophysics and Planetary Physics, Riverside, CA. Lab Helper, 1976-1977.
- Bendix United Geophysical, Richfield, Utah, Field crew worker, Summer 1976.

Certifications or professional registrations

- n/a

Current membership in professional organizations

- American Geophysical Union
- Seismological Society of America
- Society of Exploration Geophysicists

Honors and awards

Service activities (within and outside of the institution)

- Engineering Physics Advisor
- Engineering Physics Program Committee member
- Computing Committee member

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Ranasinghe, N. R., Gallegos, A., Hearn, T. M., Ni, J. F., Sandvol, E. Freqency dependent Lg attenuation in northeast China and its implications. Geophysical Journal International., Date Submitted: May 26, 2017.

- Ranasinghe, N. R. et al. (2015), Lg attenuation in northeast China using NECESSArray data, Geophys. J. Int., 200, 67–76, doi:10.1093/gji/ggu375.
- Bao, X., E. Sandvol, Y. J. Chen, J. Ni, T. Hearn, and Y. Shen (2012), Azimuthal anisotropy of Lg attenuation in eastern Tibetan Plateau, J. Geophys. Res., 117(B10), 1–14, doi:10.1029/2012JB009255.
- Wang Hai-Yang, Thomas Hearn, Chen Yong-Shun, PEI Shun-Ping, Feng Yong-Ge, Yue Han, Jin Ge, Zhou Shi-Yong, Wang Yan-Bin, Ge Zeng-Xi, Ning Jie-Yuan, Eric Sandvol, James Ni, Pn wave tomography of eastern Tibetan plateau, submitted to Chinese Journal of Geophysics.
- Liang, X., E. Sandvol, Y.J. Chen, T. Hearn, J. Ni , S. Klemperer, Y. Shen and F. Tilmann, (2012) The destruction of the underthrusted Indian plate, Earth Planet. Sci. Lett., Vol 333-334, 101-111, http://dx.doi.org/10.1016/j.epsl.2012.03.036.
- León Soto, G., E. Sandvol, J. F. Ni, L. Flesch, T. M. Hearn, F. Tilmann, J. Chen, and L. D. Brown (2012), Significant and vertically coherent seismic anisotropy beneath eastern Tibet, J. Geophys. Res., 117, B5, doi:10.1029/2011JB008919.
- Yue, H., et al. (2012), Lithospheric and upper mantle structure of the northeastern Tibetan Plateau, J. Geophys. Res., 117, B5, doi:10.1029/2011JB008545.

Briefly list the most recent professional development activities

- Submitted National Science Foundation proposal on the seismology of Burma.
- Attenuation of seismic waves beneath China.
- Pn propagation and the tectonics of the Tibetan Plateau.
- The seismic period measurement.

Heinrich (Heinz) Nakotte

Education – degree, discipline, institution, year

- Ph. D., Physics, Universiteit van Amsterdam, The Netherlands, 1994
- M.E., Education, Universität zu Köln, Germany, 1988
- B.S., Physics, Universität zu Köln, Germany, 1986

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State University (NMSU), Department of Physics, Full Professor, 2009 – present, full time
- NMSU, Department of Physics, Associate Professor, 2003 – 2009, full time
- NMSU, Department of Physics, Assistant Professor, 1997 – 2003, full time

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Guest Lecturer, South China University of Technology (Guangzhou, China), summer 2017, part time
- Los Alamos National Laboratory - Los Alamos Neutron Science Center (LANSCE), Instrument Scientist - Single Crystal Diffractometer, 2008 – 2016, part time
- Chalk River Laboratory (Chalk River, Canada), Affiliated Staff, 1994 – 2000, part time
- Los Alamos National Laboratory, Postdoctoral Associate, 1994-1997, full time
- Electrotechnical Laboratory (Tsukuba, Japan), STA Fellow (Humboldt Foundation), 1996, part time
- Bosch GmbH - Hydraulic Pump Section (Köln, Germany), Staff Member, 1989, part time
- Leybold Heraeus GmbH - Ultra High Vacuum Group (Köln, Germany), Laboratory Assistant, 1987, part time

Certifications or professional registrations

- n.a.

Current membership in professional organizations

- American Physical Society (4-Corners & Texas Sections, Division of Materials Physics)
- Neutron Scattering Society of America

Honors and awards

- Gardiner Professorship, New Mexico State University (NMSU), Department of Physics, 2009 – 2011
- Best Advising Award for Faculty, NMSU, 2010
- NMSU College of Arts & Sciences Faculty Outstanding Achievement Award in Scholarship, 2009
- NMSU Award for Exceptional Achievements in Creative Scholarly Activity, 2003
- Early CAREER Award, National Science Foundation, 2000

Service activities (within and outside of the institution)

- Chair of the Engineering Physics (EP) Program Committee, since 2009

- Chair of the Local Organizing Committee of the 2016 Joint Four-Corners/Texas Sections meeting of the American Physical Society, 2016
- Promotion & Tenure Committee of NMSU's Criminal Justice Department, since 2016
- NMSU Faculty Senator, since 2015
- Chair of the Time-of-Flight Subcommittee of Science Review Committee at Oak Ridge National Laboratory, since 2013
- Member of South Dakota State University's Physics Program Review Panel, 2013
- Editorial Board Member, International Journal of Engineering Science, since 2008

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Nakotte, H., Silkwood, C., Page, K., Wang, H.-W., Olds, D., Kiefer, B., Manna, S., Karpov, D., Fohtung, E. B., Fullerton, E. E. (2017) Pair Distribution Function Analysis applied to Decahedral Gold Nanoparticles. *Physica Scripta, 92*, 114002
- Adak, S., Hartl, M., Daemen, L., Fohtung, E. B., Nakotte, H. (2017). Study of oxidation states of the transition metals in a series of Prussian blue analogs using x-ray absorption near edge structure (XANES) spectroscopy. *Journal of Electron Spectroscopy and Related Phenomena, Elsevier, 214*, 8-19
- Jain, P., Stroppa, A., Nabok, D., Marino, A., Rubano, A., Paparo, D., Matsubara, M., Nakotte, H., Fiebig, M., Picozzi, S., Choi, E. S., Cheetham, A. K., Draxl, C., Dalal, N., Zapf, V. (2016). Switchable electric polarization and ferroelectric domains in a metal-organic-framework. *Nature Partner Journals - Quantum Materials, 1*, 16012
- Nakotte, H., Shrestha, M., Adak, S., Boergert, M., Zapf, V. S., Harrison, N., King, G., Daemen, L. L. (2016). Magnetic Properties of some Transition-Metal Prussian Blue Analogs with Composition $M_3[M'(C,N)_6]_2.xH_2O$. *Journal of Sciences - Advanced Materials and Devices, Elsevier, 1*, 113-120
- Losko, A. S., Vogel, S. C., Reiche, M., Nakotte, H. (2014). A Six-Axes Robotic Sample Changer for High-Throughput Neutron Powder Diffraction and Texture Measurements. *Journal of Applied Crystallography, 47*, 2109-2112
- Zepeda-Alacorn, E., Nakotte, H., Vogel, S., Page, K., Wang, H.-W., King, G., Gualtieri, A., Wenk, H.R. (2014). Magnetic and Nuclear Structure of Goethite alpha-FeOOH: A Neutron Diffraction Study. *Journal of Applied Crystallography, 47*, 1983-1991
- Alsmadi, A., Bsoul, I., Mahmood, S. H., Alnawashi, G., Prokes, K., Siemensmayer, K., Klemke, B., Nakotte, H. (2013). Magnetic study of M-type doped barium hexaferrite nanocrystalline particles. *Journal of Applied Physics, 114*, 243910
- Maskova, S., Havela, L., Danis, S., Llober, A., Nakotte, H., Kothapalli, K., Cerny, A., Kolomiets, A. (2013). Impact of hydrogen absorption on crystal structure and magnetic properties of geometrically frustrated Nd2Ni2In. *Journal of Alloys and Compounds - Elsevier, 566*, 22-30

- Invited Talk at *Frontiers of Theoretical and Applied Physics (FTAPS-2017)*, University of Sharjah (United Arabic Emirates), February 23, 2017
- Invited Talk at APS 4-Corners meeting, Fort Collins, October 20, 2017

Briefly list the most recent professional development activities

- Regular attendee and participant at the annual 4-Corners Section meetings of the American Physical Society (2013-2017)

Vassili Papavassiliou

Education – degree, discipline, institution, year

- Ph. D., Physics, Yale University, USA, 1988
- M.Sc., M.Phil, Yale University, USA 1985
- B.S., Physics, Aristotelion University, Thessaloniki, Greece, 1982

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- NMSU, Department of Physics, Associate Professor, 2001 – present, full time
- NMSU, Department of Physics, Assistant Professor, 1995 – 2001, full time

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- URA Visiting Scholar, Fermi National Accelerator Lab, 2016 – 2017, part time
- Visiting Scientist, Fermi National Accelerator Lab, 2009 – 2010, part time
- Senior Research Associate, Illinois Institute of Technology, 1994 – 1995, full time
- Postdoctoral Appointee, Argonne National Lab, 1991 – 1994, full time
- Research Associate, Yale University, 1988 – 1991, full time
- Research Assistant, Yale University, 1984 – 1988, part time
- Teaching Assistant, Yale University, 1982 – 1983, part time

Certifications or professional registrations

- n.a.

Current membership in professional organizations

- n.a.

Honors and awards

- n.a.

Service activities (within and outside of the institution)

- Physics Graduate Program Director, since 2010

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- MicroBooNE Collaboration, R. Acciarri et al. (2017). Michel Electron Reconstruction Using Cosmic-Ray Data from the MicroBooNE LArTPC. *JINST 12*, P09014
- PHENIX Collaboration, C. Aidala et al. (2017). Cross section and transverse single-spin asymmetry of muons from open heavy-flavor decays in polarized *p*+*p* collisions at $\sqrt{s}$ = 200 GeV. *Phys.Rev. D95*, 112001
- MicroBooNE Collaboration, P. Abratenko et al. (2017). Determination of muon momentum in the MicroBooNE LArTPC using an improved model of multiple Coulomb scattering. *JINST 12*, P10010.
- PHENIX Collaboration, A. Adare et al. (2017). Angular decay coefficients of J/ψ mesons at forward rapidity from *p*+*p* collisions at $\sqrt{s}$ = 510 GeV. *Phys.Rev. D95*, 092003

- MicroBooNE Collaboration, R. Acciarri et al. (2017). Design and Construction of the MicroBooNE Detector. *JINST 12*, P02017
- MicroBooNE Collaboration, R. Acciari et al. (2017). Convolutional Neural Networks Applied to Neutrino Events in a Liquid Argon Time Projection Chamber. *JINST 12*, P03011
- PHENIX Collaboration, A. Adare et al. (2016). Measurements of double-helicity asymmetries in inclusive J/ψ production in longitudinally polarized *p+p* collisions at $\sqrt{s}$ = 510 GeV. *Phys.Rev. D94*, 112008
- PHENIX Collaboration, A. Adare et al. (2016). Centrality-dependent modification of jet-production rates in deuteron-gold collisions at $\sqrt{s_{NN}}$ = 200 GeV. *Phys. Rev. Lett. 116*, 122301
- PHENIX Collaboration, A. Adare et al. (2016). Measurement of parity-violating spin asymmetries in $W^{\pm}$ production at midrapidity in longitudinally polarized *p+p* collisions. *Phys. Rev. D93*, 051103
- PHENIX Collaboration, A. Adare et al. (2015). Charged-pion cross sections and double-helicity asymmetries in polarized *p+p* collisions at $\sqrt{s}$ = 200 GeV. *Phys. Rev. D91*, 032001
- PHENIX Collaboration, A. Adare et al. (2015). Cross section for *bb* production via dielectrons in d + Au collisions at $\sqrt{s_{NN}}$ = 200 GeV. *Phys. Rev. C91*, 014907
- PHENIX Collaboration, A. Adare et al. (2015). Measurement of long-range angular correlation and quadrupole anisotropy of pions and (anti)protons in central d + Au collisions at $\sqrt{s_{NN}}$ = 200 GeV. *Phys. Rev. Lett. 114*, 192301
- PHENIX Collaboration, A. Adare et al. (2014). Azimuthal-angle dependence of charged-pion-interferometry measurements with respect to second- and third-order event planes in Au + Au collisions at $\sqrt{s_{NN}}$ = 200 GeV. *Phys. Rev. Lett. 112*, 222301
- PHENIX Collaboration, A. Adare et al. (2014). Measurement of transverse-single-spin asymmetries for midrapidity and forward-rapidity production of hadrons in polarized *p+p* collisions at $\sqrt{s}$ = 200 GeV and 62.4 GeV. *Phys. Rev. D90*, 012006
- PHENIX Collaboration, C. Aidala et al. (2014). The PHENIX Forward Silicon Vertex Detector. *Nucl. Instrum. Meth. A755*, 44
- PHENIX Collaboration, A. Adare et al. (2013). Nuclear Modification of ψ′, χ_c, and J/ψ Production in d + Au Collisions at $\sqrt{s_{NN}}$ = 200 GeV. *Phys. Rev. Lett. 111*, 202301
- PHENIX Collaboration, A. Adare et al. (2013). Medium modification of jet fragmentation in Au + Au collisions at $\sqrt{s_{NN}}$ = 200 GeV. measured in direct photon-hadron correlations. *Phys. Rev. Lett. 111*, 032301

Briefly list the most recent professional development activities

- Attended 2017 Meeting of the American Physical Society Division of Particles and Fields, Batavia, IL
- Attended PhyStat-ν Fermilab 2016 Workshop on Statistical Issues in Experimental Neutrino Physics, Batavia, IL

Stephen Pate

Education – degree, discipline, institution, year

- Ph.D., Physics, University of Pennsylvania, 1987
- B.S., Physics, North Carolina State University, 1981

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State University (NMSU), Department of Physics, Full Professor, 2006 – present, full time
- NMSU, Department of Physics, Associate Professor, 2001 – 2006, full time
- NMSU, Department of Physics, Assistant Professor, 1995 – 2001, full time

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Post-doctoral researcher, University of Pennsylvania, 1987-1988, full time
- Post-doctoral researcher, Indiana University, 1988-1991, full time
- Post-doctoral researcher, Massachusetts Institute of Technology, 1992-1993, full time
- Research Scientist, Massachusetts Institute of Technology, 1993-1995, full time

Certifications or professional registrations

- n.a.

Current membership in professional organizations

- American Physical Society, life member
- American Association of Physics Teachers, life member

Honors and awards

- Gardiner Professorship, New Mexico State University (NMSU), Department of Physics, 2005 – 2007
- NMSU College of Arts & Sciences Faculty Outstanding Achievement Award in Scholarship, 2013
- NMSU Research Achievement Award, 2013
- NMSU Research Achievement Award, 2015

Service activities (within and outside of the institution)

- Member of the Engineering Physics (EP) Program Committee, 2004-present
- Member of the Local Organizing Committee of the 2016 Joint Four-Corners/Texas Sections meeting of the American Physical Society, 2016
- Chair of Physics Department Promotion & Tenure Committee, 2011-present
- Chair of Physics Department Instructional Laboratory Committee, 2015-present
- Academic Advisor to Physics Students, 1999-present
- NMSU Faculty Senator, 2003-2006
- Reviewer for manuscripts submitted to Physical Review Letters, Physical Review C, and The American Journal of Physics
- Reviewer of funding proposals submitted to the NSF and the DOE

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- C. Aidala et al. [PHENIX Collaboration], "Cross section and transverse single-spin asymmetry of muons from open heavy-flavor decays in polarized *p*+*p* collisions at $\sqrt{s}$ = 200 GeV," Phys. Rev. D 95, no. 11, 112001 (2017)
- C. Aidala et al. [PHENIX Collaboration], "Measurements of $B \rightarrow J/\psi$ at forward rapidity in *p*+*p* collisions at $\sqrt{s}$ =510 GeV," Phys. Rev. D 95, no. 9, 092002 (2017)
- R. Acciarri et al. [MicroBooNE Collaboration], "Design and Construction of the MicroBooNE Detector," JINST 12, no. 02, P02017 (2017)
- R. Acciarri et al. [MicroBooNE Collaboration], "Convolutional Neural Networks Applied to Neutrino Events in a Liquid Argon Time Projection Chamber," JINST 12, no. 03, P03011 (2017)
- A. Adare et al. [PHENIX Collaboration], "Measurements of double-helicity asymmetries in inclusive J/ψ production in longitudinally polarized *p*+*p* collisions at $\sqrt{s}$ =510 GeV," Phys. Rev. D 94, no. 11, 112008 (2016)
- Stephen Pate [for the MicroBooNE Collaboration], "Progress on Neutrino-Proton Neutral-Current Scattering in MicroBooNE," International Nuclear Physics Conference, 11 September 2016, Adelaide, Australia; PoS INPC 2016, 260 (2017)
- C. Aidala, L. Anaya, E. Anderssen, A. Bambaugh, A. Barron, J.G. Boissevain, J. Bok, S. Boose et al., "The PHENIX Forward Silicon Vertex Detector," Nucl. Instrum. Meth. A 755 (2014) 44
- S. Pate and D. Trujillo, "Strangeness Vector and Axial-Vector Form Factors of the Nucleon," EPJ Web Conf. 66, 06018 (2014)
- D. Androic et al. [G0 Collaboration], "Measurement of the parity-violating asymmetry in inclusive electroproduction of π^- near the Δ^0 resonance," Phys. Rev. Lett. 108 (2012) 122002

Briefly list the most recent professional development activities

- Joint Four-Corners/Texas Sections meeting of the American Physical Society, October 2016, Las Cruces NM
- International Nuclear Physics Conference, September 2016, Adelaide, Australia
- Four Corners Section meeting of the American Physical Society, Oct. 2015, Tempe AZ
- Fall Meeting of the APS Division of Nuclear Physics, October 2015, Santa Fe NM

Jacob Urquidi

Education – degree, discipline, institution, year

- Ph.D. in Physical Chemistry, Texas Tech University, Lubbock, Texas. Dissertation: Theoretical Studies on Liquid Water (2001)
- M.S. in Physical Chemistry, Texas Tech University, Lubbock, Texas. Thesis: The Structure of Liquid Water Explained by a Two-State Model (2000)
- B.S. in Chemistry with a minor in Physics and Biology, University of Texas at El Paso, El Paso, Texas (1994)

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State University, Department of Physics, Associate Professor of Physics, 2009 – present, full time
- New Mexico State University, Department of Physics, New Mexico State LANSCE Professor of Physics (Tenure Track Assistant Professor, New Mexico State University, Las Cruces, NM and Los Alamos Neutron Scattering Center (LANSCE), Lujan Center, Los Alamos, New Mexico, 2003 – 2009, Full time
- Postdoctoral Research Scientist on disordered materials at the Intense Pulsed Neutron Source (IPNS), Argonne National Laboratory, Argonne, IL. Post-Doc Advisor: Chris Benmore, 2001 – 2003, Full time

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- N.A.

Certifications or professional registrations

- N.A.

Current membership in professional organizations

- American Physical Society
- American Chemical Society
- National Society of Hispanic Physicists

Honors and awards

- N.A.

Service activities (within and outside of the institution)

- President Elect, National Society of Hispanic Physicists; 2018 – 2024
- ORNL Neutron Sciences Review Committee, member; 2017-2018
- NSF Materials Division, Grant Proposal Review; 2016-2017
- Health and Safety Officer; 2016 - present
- Departmental Space Committee, member; 2012 - present
- Departmental Lab Committee, member; 2009 – present

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- McPhearson, G. Amburgey, J., Urquidi, J. Castillo, M., Wavelength dependence of the environmental light-cued daily ejection of bacterial symbionts in Euprymna scolopes; Submitted to Journal of Biorhythms (2018)
- Urquidi, J., Future challenges, working together, and high-hanging fruit" or "The things not said in science.", Keynote presentation, New Mexico AMP Undergraduate Research Conference, Las Cruces, NM (2017)
- Urquidi, Jacob, Brar, Ramaninder K., Rodriguez, Stacy, and Hansen, Immo, The development of new radiation protocols for insect sterilization using long wavelength x-rays; AIP Conference Proceedings, 1671, 020010 (2015)
- Rodriguez, S.D., Brar, R.K., Drake, L.L., Drumm, H.E., Price, D.P., Hammond, J.L., Urquidi, J., and Hansen, I.A., *The effect of radio-protective agents ethanol, thrmethylglycine, and beer on survival of X-ray sterilized male Aedes aegypti*; Parasite Vectors 6:211 (2013

Briefly list the most recent professional development activities

- N.A.

Igor Vasiliev

Education – degree, discipline, institution, year

- Ph.D., Materials Science, University of Minnesota, Minneapolis, Minnesota, 2000
- M.S., Chemical Physics, Moscow Institute of Physics and Technology, Moscow, Russia, 1993
- B.S., Chemical Physics, Moscow Institute of Physics and Technology, Moscow, Russia, 1991

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State University, Department of Physics, Full Professor, 2014 – present, full time
- New Mexico State University, Department of Physics, Associate Professor, 2008 – 2014, full time
- New Mexico State University, Department of Physics, Assistant Professor, 2002 – 2008, full time
- University of Illinois at Urbana-Champaign, Department of Physics, Postdoctoral Research Associate, 2000 – 2002, full time

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Sandia National Laboratories, Visiting Scientist, 2016, part time
- Institute of Chemical Physics, Chernogolovka, Russia, Staff Member, 1993 – 1994, full time

Certifications or professional registrations

- n.a.

Current membership in professional organizations

- American Physical Society
- Materials Research Society

Honors and awards

- J. Tinsley Oden Fellowship, University of Texas at Austin, 2008 – 2009

Service activities (within and outside of the institution)

- Engineering Physics Program Committee, member since 2010
- Physics Department Curriculum Committee, chair since 2009
- NMSU Faculty Senate, member 2012 – 2015
- NMSU Scholastic Affairs Committee, member 2012 – 2013
- NMSU Faculty Affairs Committee, member 2013 – 2015
- College of Arts & Sciences Faculty Affairs Committee, member since 2017
- Physics Department Computer Committee, chair 2002 – 2012, member since 2014
- Physics Department Graduate Admission Committee, member since 2008
- Physics Department Tenure & Promotion Committee, member since 2008, chair 2015 – 2016

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- M. Hammouri and I. Vasiliev, Ab Initio Study of the Electronic and Transport Properties of Waved Graphene Nanoribbons, *Physica E 89*, 170−176 (2017).
- M. Hammouri, E. Fohtung, and I. Vasiliev, Ab Initio Study of Magnetoelectric Coupling in $La_{0.67}Sr_{0.33}$ $MnO_3/PbZr_{0.2}Ti_{0.8}O_3$ Multiferroic Heterostructures *J. Phys.: Condens. Matter 28*, 396004 (2016).
- M. Hammouri, S. K. Jha, and I. Vasiliev, First-Principles Study of Graphene and Carbon Nanotubes Functionalized with Benzyne, *J. Phys. Chem. C 119*, 18719−18728 (2015).
- L. V. Frolova, I. V. Magedov, A. Harper, S. K. Jha, M. Ovezmyradov, G. Chandler, J. Garcia, D. Bethke, E. A. Shaner, I. Vasiliev, and N. G. Kalugin, Tetracyanoethylene Oxide-Functionalized Graphene and Graphite Characterized by Raman and Auger Spectroscopy, *Carbon 81*, 216−222 (2015).
- S. Alnemrat, Y. H. Park, and I. Vasiliev, Ab Initio Study of ZnSe and CdTe Semiconductor Quantum Dots, *Physica E 57*, 96−102 (2014).
- L. S. Abdallah, T. M. Tawalbeh, I. V. Vasiliev, S. Zollner, C. Lavoie, A. Ozcan, and M. Raymond, Optical Conductivity of $Ni_{1-x}Pt_x$ Alloys ($0 < x < 0.25$) from 0.76 to 6.6 eV, *AIP Advances 4*, 017102 (2014).
- S. Alnemrat, J. P. Hooper, I. Vasiliev, and B. Kiefer, The Role of Equilibrium Volume and Magnetism on the Stability of Iron Phases at High Pressures, *J. Phys.: Condens. Matter 26*, 046001 (2014).

- Invited Talk at APS Joint Four Corners and Texas Sections Meeting, Las Cruces, New Mexico, October 21, 2016
- Invited Talk at CECAM Workshop on DFT and TDDFT in the Real-Space Formalism within the PARSEC Code: Perspectives and Future Development, Tel Aviv, Israel, December 15, 2015.
- Invited Talk at Workshop on Nanomaterials: Computation, Theory, and Experiment, Telluride, Colorado, June 30, 2015.

Briefly list the most recent professional development activities

- Attendance of DOE/OE Energy Storage Peer Review, Washington D.C., September 25 – 28, 2016
- Attendance of New Mexico Regional Energy Storage and Grid International Workshop, Albuquerque, New Mexico, August

Lauren Waszek

Education – degree, discipline, institution, year

- Ph.D., Earth Sciences, University of Cambridge, 2012
- M.Sci., Experimental and Theoretical Physics, University of Cambridge, 2008
- B.A., Experimental and Theoretical Physics, University of Cambridge, 2008

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- Australian National University, Discovery Early Careers Research Award fellow, 2017 – present, full time
- New Mexico State University, Assistant Professor, 2016 – present, full time
- University of Maryland, Postdoctoral Research Associate, 2015 – 2016, full time
- University of Liverpool, Honorary Research Fellow, 2015, full time
- University of Cambridge, Junior Research Fellow, 2012 – 2015, full time

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- N/A

Certifications or professional registrations

- N/A

Current membership in professional organizations

- American Geophysical Union

Honors and awards

- Australian Research Council Discovery Early Careers Research Award DE170100329
- National Science Foundation Equipment Grant EAR-661985
- Waszek et al., 2011 Nature Geoscience five year anniversary 10 favorite papers

Service activities (within and outside of the institution)

- Graduate Admissions Committee, 2017
- Society of Physics advisor, 2016 – present
- Convener, American Geophysical Union Fall Meeting 2017
- Peer reviewer, National Science Foundation, Geophysics Research Letters, Physics of the Earth and Planetary Interiors, Pure and Applied Geophysics

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Lasbleis, M., Waszek, L., Day, E. GrowYourIC: a step towards a coherent model of seismic structure. Geochem. Geophys. Geosys., in press, 2017.
- Waszek, L., Deuss, A. Anomalously large PKiKP-PcP amplitude ratios on a global scale. J. Geophys. Res., 120, doi:10.1002/2015JB012038, 2015.
- Waszek, L., Thomas, C., Deuss, A. PKP precursors: implications for global scattering. Geophys. Res. Lett., 42:1-10, 2015.

- Blom, N., Deuss, A., Paulssen, H., Waszek, L. Earth's inner core: revealing the structures behind the PKP core phase triplication. Geophys. J. Int., 201(3):1657-1665, 2015.
- Waszek, L., Deuss, A. Observations of exotic inner core waves. Geophys. J. Int., 200(3):1636-1650, 2015.
- Waszek, L., Deuss, A. A low attenuation layer in Earth's uppermost inner core, Geophys. J. Int., 195(3):2005-2015, 2013.

Presentations:

- Multiple approaches for mapping regional structures of Earth's inner core. IAG-IASPEI Joint Scientific Assembly, Japan, invited talk, August 2017
- Linking the seismic structure of Earth's uppermost inner core to features at the inner core boundary. ETH Zürich, invited seminar, August 2016
- Linking the seismic structure of Earth's uppermost inner core to features at the inner core boundary. California Institute of Technology, invited colloquium, April 2016
- Constraining the seismic properties of Earth's inner core. Tokyo Institute of Technology, invited seminar, November 2015
- Linking seismic observations of Earth's inner core boundary to deeper structure. Workshop on The Earth's Mantle and Core: Structure, Composition, Evolution, Japan, invited talk, November 2015
- Seismic observations of Earth's inner core: hemispheres, anisotropy and super-rotation. University of Chicago, invited colloquium, January 2015

Briefly list the most recent professional development activities

- Participant, American Association of Physics Teachers New Faculty Workshop, November 2017
- Invited participant, Workshop on The Earth's Mantle and Core: Structure, Composition, Evolution, Japan, July 2017
- Cooperative Institute for Dynamic Earth Research participant, July 2014

Stefan Zollner

Education – degree, discipline, institution, year

- Ph.D. Physics, 1991. *Universität Stuttgart,* Germany
- M.S. Physics, 1987. *Universität Stuttgart,* Germany
- B.S. Physics, 1984. *Universität Regensburg,* Germany

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- *New Mexico State University*, Department of Physics, Las Cruces, NM: Full Professor and Academic Department Head, July 2010 – present; full-time
- *Iowa State University*, Department of Physics and Astronomy, Ames, IA: Assistant Professor, September 1992 – May 1997; full-time.
- *Arizona State University*, Department of Physics and Astronomy, Tempe, AZ: Adjunct Professor, August 2001 – present.

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- *International Business Machines Corporation*, East Fishkill, NY: Process Integration Engineer, November 2008 – June 2010, full-time
- *Freescale Semiconductor, Inc*, Tempe, AZ, Austin, TX, and East Fishkill, NY: Analytical Engineer, Semiconductor Device Engineer, Process Integration Engineer (various positions), April 2004 – November 2008, full-time.
- *Motorola, Inc., Semiconductor Products Sector*, Mesa, AZ, and Tempe, AZ: Analytical Engineer, Section Manager (various positions), May 1997 – April 2004, full-time.
- *Ames Laboratory*, Ames, IA: Associate Physicist, September 1992 – May 1997, full-time.
- *IBM Research Division*, Yorktown Heights, NY: April 1991 – August 1992, IBM World Trade Postdoctoral Research Associate, full-time.

Certifications or professional registrations

- None

Current membership in professional organizations

- Fellow of the American Physical Society (APS)
- Member of the Four-Corners, New York, and Texas Sections of the APS
- Member of the Division of Condensed Matter Physics of the APS
- Member of the Division of Materials Physics of the APS
- Member of the Forums of Industrial & Applied Physics of the APS
- Fellow of the American Vacuum Society (AVS)
- Senior Member of the IEEE, Electron Devices Society
- Member of the German Physical Society (DPG)
- Member of the American Association of Physics Teachers (AAPT)

Honors and awards

- *German Scholarship Foundation* (Studienstiftung des deutschen Volkes), 1981-1987.
- *Fulbright Exchange Scholarship*, 1984-1985 (Arizona State University, Tempe)

- *IEEE Senior Member.*
- *Fellow of the American Physical Society*
- *Fellow of the American Vacuum Society*

Service activities (within and outside of the institution)

- *Academic Department Head,* Department of Physics, NMSU, since July 2010.
- *Board Member*, New Mexico Consortium, since September 2015.
- *Co-Chair*, Local Organizing Committee, Joint Meeting of the Texas and Four Corners Sections of the American Physical Society (APS), October 21-22, 2016, Las Cruces, NM.
- *Proceedings Editor,* International Conference on Spectroscopic Ellipsometry, Barcelona, Spain, Summer 2019.
- *Executive Committee Member*, New Mexico Chapter of the AVS, since 2011.

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- C. Xu, N.S. Fernando, S. Zollner, J. Kouvetakis, and J. Menendez, *Observation of phase-filling singularities in the optical dielectric function of highly doped n-type Ge*, Phys. Rev. Lett. **118**, 267402 (2017).
- D. Pal, J. Singhal, A. Mathur, A. Singh, S. Dutta, S. Zollner, and S. Chattopadhyay, *Effect of substrates and thickness on optical properties in atomic layer deposition grown ZnO thin films*, Appl. Surf. Sci. **421** B, 341 (2017).
- S. Zollner, T.N. Nunley, D.P. Trujillo, L.G. Pineda, and L.S. Abdallah, *Temperature-dependent dielectric function of nickel*, Appl. Surf. Sci. **421** B, 913 (2017).
- T.N. Nunley, T.I. Willett-Gies, J.A. Cooke, F. Manciu, P. Marsik, C. Bernhard, and S. Zollner, *Optical constants, band gap, and infrared-active phonons of* $(LaAlO_3)_{0.3}(Sr_2AlTaO_6)_{0.35}$ *(LSAT) from spectroscopic ellipsometry*, J. Vac. Sci. Technol. A **34**, 051507 (2016).
- A.B. Posadas, C. Lin, A.A. Demkov, and S. Zollner, Band gap engineering in perovskite oxides: Al-doped $SrTiO_3$, Appl. Phys. Lett. **103**, 142906 (2013).
- S. Zollner, "Spectroscopic Ellipsometry for Inline Process Control in the Semiconductor Industry", in Ellipsometry at the Nanoscale, edited by M. Losurdo and K. Hingerl (Springer, Heidelberg, 2013).
- D.G. Seiler, S. Zollner, A.C. Diebold, and P.M. Amirtharaj, "Optical Properties of Semiconductors", in Handbook of Optics, Vol. IV, edited by M. Bass (Optical Society of America, 3rd edition, New York, 2010).
- Stefan Zollner, Veer Dhandapani, Paul Grudowski, and Greg Spencer, Anneal of epitaxial layer in a semiconductor device, US patent 7,416,605 B2 issued on 26 August 2008

Briefly list the most recent professional development activities

- Annual Physics Department Chairs Conference, American Physical Society, American Center for Physics, College Park, MD, June 5-7, 2015.
- Experienced Faculty Workshop, American Association of Physics Teachers, University of Minnesota, Minneapolis, MN, July 24-26, 2014.

Engineering Physics Program
(Bachelor of Science in Engineering Physics)

at

New Mexico State University

Temporary Instructors – Department of Physics

Farzin Abadizaman

Education – degree, discipline, institution, year

- Ph. D. Candidate, Physics, New Mexico State University, Las Cruces, NM, United States, 2015 September to present.
- M.S., Physics, New Mexico State University, Las Cruces, NM, United States (fall 2017 expected).
- M.S., Physics, Tehran University, Tehran, Iran (Feb 2012).
- B.S., Physics, Shahrood University of Technology, Shahrood, Iran, 2009.

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State University (NMSU), Department of Physics, Teaching assistant, September 2015 to present, part time.
- NMSU, Department of Physics, Research assistant, July 2016- August 2016, July 2017 – August 2017, part time.
- NMSU, Department of Physics, Instructor for Engineering and General Physics Lab - PHYS 215GL, PHYS 211GL, PHYS 213GL Summer -2016 and 2017, Fall 2016.
- Sattari Airforce University, Tehran, Iran, Department of Physics, Teaching Mechanics, Electricity & Magnetism, General Physics, February 2013 – May 2015.

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- n.a.

Certifications or professional registrations

- n.a.

Current membership in professional organizations

- American Vacuum Society (AVS).
- American Physical Society (APS).

Honors and awards

- Outstanding graduate assistant award, April 2017.

Service activities (within and outside of the institution)

- Volunteer judge for the Southwestern New Mexico Regional and Engineering Fair, Las Cruces, NM, Feb 2016.
- President of Physics Graduate Student Organization, New Mexico State University (2016- 2017).

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- F. Abadizaman, P. Paradis, S. Zollner, Temperature Dependent Mueller Matrix Measurements of Magnetized Ni near the Curie Temperature, AVS 64th International Symposium & Exhibition, Tampa, Florida, October 30 – November 3, 2017.
- F. Abadizaman, S. Zollner, Temperature Dependent Mueller Matrix Measurements of Magnetized Ni near the Curie Temperature, AVS New Mexico Symposium, Albuquerque, NM, May 16th, 2017.
- F. Abadizaman, J. Moya, S. Zollner, Experimental errors in Mueller matrix elements of isotropic samples, APS Four Corners Section Meeting, Las Cruces, NM, 21-22 October 2016.

Briefly list the most recent professional development activities

- Regular attendee and participant at the annual AVS International Symposium and Exhibition (2016-2017).

Federico Alvarez

Education – degree, discipline, institution, year

- B.A., Physics, New Mexico State University, 2017
- M.S., Industrial Engineering, 2013
- B.A., Economics, University of Illinois at Chicago, 2011

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- T.A, New Mexico State University (NMSU), Department of Physics, 2017 – present ,full time

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Centennial High School (Las Cruces, NM), Mathematics Teacher, 2015 –2016, full time
- Cesar Chavez Charter High School (Deming, NM), Mathematics Teacher, 2014 –2015, full time
- Las Montanas High School (Las Cruces, NM), Mathematics Tutor, 2013 – 2014 , full time
- Southwest Cheese (Clovis, NM), Industrial Engineering Intern, 2012, full time

Certifications or professional registrations

- NM Level 1 Teaching License with Math and Science endorsement

Current membership in professional organizations

- n.a

Honors and awards

- n.a

Service activities (within and outside of the institution)

- n.a

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- n.a

Briefly list the most recent professional development activities

- n.a

Fatma Pinar Aslan

Education – degree, discipline, institution, year

- Ph. D., Physics, New Mexico State University, Las Cruces, NM, U.S.A, Expected graduation May 2018
- M.S., Physics Engineering, Istanbul Technical University, Istanbul, Turkey, 2009
- B.S., Physics Engineering, Hacettepe University, Ankara, Turkey, 2005

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State University (NMSU), Department of Physics, Teaching Assistant, 20012 – present, full time
-

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- n.a.

Certifications or professional registrations

- n.a.

Current membership in professional organizations

- American Physical Society (Division of Nuclear Physics)

Honors and awards

- American Association of Physics Teachers-Outstanding Physics Teaching Assistant-2014
- NMSU- Preparing Future Faculty Graduate Assistantship Award 2016-2017

Service activities (within and outside of the institution)

- n.a.

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- n.a.

Briefly list the most recent professional development activities

- n.a.

Nalin S. Fernando

Education – degree, discipline, institution, year

- Ph. D., Physics, New Mexico State University, 2017
- M.S., Physics, New Mexico State University, 2013
- B.S., Engineering Physics, University of Colombo, Sri Lanka, 2009

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- NMSU, Department of Mathematical Sciences, College Assistant Professor, August 2017- October 2017, part time
- New Mexico State University (NMSU), Department of Physics, Tutor, June 2017 – August 2017, part time
- New Mexico State University (NMSU), Department of Physics, Graduate Assistant, August 2010 – May 2017, part time
- University of Colombo, Sri Lanka, Department of Physics, Teaching Assistant, September 2009 – July 2010

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Intel Corporation, Process Engineer, October 2017- present, full time
- Department of Physics, NMSU, Computer system administrator, December 2014 – May 2015, part time.
- Los Alamos National Lab High Performance Computing Mini-Bootcamp (August-2016), part time.

Certifications or professional registrations

- n.a

Current membership in professional organizations

- American Physical Society (AVS)
- American Vacuum Society (AVS)

Honors and awards

- n.a

Service activities (within and outside of the institution)

- n.a

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- N.S. Fernando, R. Hickey, J. Hart, D. Zhang, R. Hazbun, J. Kolodzey, and S. Zollner, *Strain dependence of the band structure and optical properties of pseudomorphic* $Ge_{1-x-y}Si_xSn_y$ *on Ge* (submitted, 1st review).
- N. S. Fernando, T.N. Nunley, A. Ghosh, C.M. Nelson, J. Cooke, A. A. Medina, C. Xu, J. Menendez, J. Kouvetakis, S. Zollner, *Temperature dependence of the interband critical points of bulk Ge and strained Ge on Si*, Appl. Surf. Sci., **XX**, XXXX (2016). (in press)

- C. Xu, N.S. Fernando, S. Zollner, J. Kouvetakis, and J. Menéndez, *Observation of phase-filling singularities in the optical dielectric function of highly doped n-type Ge*, Phys. Rev. Lett. **118**, 267402 (2017).
- Ryan Hickey, Nalin Fernando, John Hart, Ramsey Hazbun, Stefan Zollner and James Kolodzey, *Properties of pseudomorphic and relaxed Germanium$_{1-x}$Tin$_x$ alloys with Tin Contents up to 18.5 Percent grown by MBE,* J. Vac. Sci. Technol. B **35**, 021205 (2017).
- T.N. Nunley, N.S. Fernando, N. Samarasingha, J.M. Moya, C.M. Nelson, A.A. Medina, S. Zollner, *Optical constants of germanium and thermally grown germanium dioxide from 0.5 to 6.6 eV via a multi-sample ellipsometry investigation,* J. Vac. Sci. Technol. B **34**, 061205 (2016).
  - R. H azbun, J. Hart, R. Hickey, A. Ghosh, N. Fernando, S. Zollner, T. Adam, and J. Kolodzey, *Silicon epitaxy using tetrasilane at low temperatures in ultra high vacuum chemical vapor deposition,* J. Crystal Growth, **444,** (2016).
  - J. Hart, R. Hazbun, D. Eldridge, R. Hickey, N. Fernando, T. Adam, S. Zollner, and J. Kolodzey, *Tetrasilane and Digermane for the ultra-high vacuum chemical vapour deposition of SiGe alloys,* Thin Solid Films **604,** (2016).

Briefly list the most recent professional development activities

- International Conference on Frontiers of Characterization and Metrology for Nanoelectronics (FCMN), Monterey, CA, 21-23 March 2017.
- American Vacuum Society (AVS) 63rd International Symposium, Nashville, TN, 6-11 November 2016.
- IEEE Summer Topicals Conference on Emerging Technology for Integrated Photonics, Newport Beach, CA, 11-13 July 2016.

Galen Helms

Education – degree, discipline, institution, year

- B.S., Engineering Physics, New Mexico State University, Las Cruces, 2015

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State University (NMSU), Department of Physics, Lab Coordinator, 2016 – 2107, full time

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Desert Dough Pizza Inc. DBA Domino's Pizza, Director of Training, Management and new employee training for franchise, 2006-2011, part time

Certifications or professional registrations

- n.a.

Current membership in professional organizations

- n.a.

Honors and awards

- Nominated and inducted into ΣΠΣ

Service activities (within and outside of the institution)

- n.a.

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- n.a.

Briefly list the most recent professional development activities

- n.a.

Greggory McPherson

Education – degree, discipline, institution, year

- M.S., Physics, New Mexico State University, USA, 2014
- B.S., Physics, New Mexico State University, USA, 2011

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State University (NMSU), Department of Physics, Teaching Assistant, 20012 – present, part time
- NMSU, Department of Physics, Undergraduate Tutor, 2009-2010, part time

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- n.a.

Certifications or professional registrations

- n.a.

Current membership in professional organizations

- American Physical Society (4-Corners Section, Division of Materials Physics)
- Biophysical Society

Honors and awards

- Outstanding Teaching Assistant, NMSU Department of Physics, 2017

Service activities (within and outside of the institution)

- Officer in the Physics Graduate Student Organization, NMSU, President (2015), Treasurer (2016-present)

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Contributed Poster at APS Texas 4-Corners Joint Meeting, Las Cruces, October 10, 2016
- Urquidi, J., Anovitz, L. M., Amburgey, J. Contributed Talk at APS 4-Corners Section Meeting, Orem Utah, October 17, 2014
- Contributed Talk at Graduate Research and Arts Symposium, New Mexico State University, Las Cruces, April 7, 2013

Briefly list the most recent professional development activities

- Attended faculty workshop hosted by NMSU Teaching Academy: "Getting Our Students to Work in Every Class - From Fast-Paced Formative Feedback Techniques to Facilitating Collaborative Problem Solving in a Flipped Course" by Dr. Edward Prather, January 30, 2017

Nathan Nunley

Education – degree, discipline, institution, year

- Ph.D., Physics, The University of Texas at Austin, In Progress
- M.S., Physics, New Mexico State University, 2016
- B.S., Engineering Physics, New Mexico State University, 2015

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- The University of Texas at Austin, Department of Physics, Graduate Teaching Assistant, Fall 2016-Present, part time
- The University of Texas at Austin, Department of Physics, Graduate Research Assistant, May 2017-August 2017, full time
- NMSU, Department of Physics, Graduate Research Assistant, August 2015-July 2016, full time
- NMSU, Department of Physics, Undergraduate Research Assistant, Spring 2015-Fall 2012, part time
- NMSU, Department of Physics, Supplemental Instruction Teacher, Fall 2015-Spring 2016, part time
- NMSU, Department of Physics, Graduate Teaching Assistant, Fall 2015-Spring 2016, part time
- NMSU, Department of Physics, Peer Learning Assistant, Fall 2014-Spring 2015, part time
- NMSU, Department of Chemistry, Supplemental Instruction Facilitator, Spring 2013-Spring 2014, part time

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Air Force Research Laboratory, Kirtland Air Force Base, Phillips Scholar, Summer 2015, full time

Certifications or professional registrations

- N/A

Current membership in professional organizations

- American Physical Society (Texas Section, DMP, DCMP)
- American Association of Physics Teachers
- IEEE

Honors and awards

- Physics Department Top Graduate Teaching Assistant, Spring 2016
- Crimson Scholar Graduate with Honors, Spring 2015
- Physics Department Outstanding Graduating Senior, Spring 2015
- Physics Department Top Undergraduate Teaching Assistant, Spring 2015
- New Mexico Space Grant Consortium Undergraduate Scholarship, 2013-2015

Service activities (within and outside of the institution)

- N/A

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- N.S. Fernando, T.N. Nunley, A. Ghosh, C.M. Nelson, J.A. Cooke, A.A. Medina, S. Zollner, C. Xu, J. Menendez, and J. Kouvetakis, Temperature dependence of the interband critical points of bulk Ge and strained Ge on Si, *Appl. Surf. Sci.* 421 B, 905-912 (2017).
- T.N. Nunley, T.I. Willett-Gies, J.A. Cooke, F.S. Manciu, P. Marsik, C. Bernhard, and S. Zollner, Optical constants, band gap, and infrared-active phonons of $(LaAlO_3)_{0.3}(Sr_2AlTaO_6)_{0.35}$ (LSAT) from spectroscopic ellipsometry, *J. Vac. Sci. Technol. A* 34, 051507 (2016)
- T.N. Nunley, N.S. Fernando, N. Samarasingha, J.M. Moya, C.M. Nelson, A.A. Medina, and S. Zollner, Optical constants of germanium and thermally grown germanium dioxide from 0.5 to 6.6eV via a multisample ellipsometry investigation, *J. Vac. Sci. Technol. B* 34, 061205 (2016).
- S. Zollner, T.N. Nunley, D.P. Trujillo, L. G. Pineda, and L. S. Abdallah, Temperature-dependent dielectric function of nickel, *Appl. Surf. Sci.* 421 B, 913-916 (2017).
- T.N. Nunley, N.S. Fernando, J.M. Moya, C.M. Nelson, A.A. Medina, and S. Zollner, Optical constants of Ge and thermally grown GeO2 from 0.5 to 6.6 eV via multi-sample ellipsometry, *7th International Conference on Spectroscopic Elipsometry*, Berlin, Germany, June 7th, 2016
- O'Hara, T.N. Nunley, A.B. Posadas, S. Zollner, and A.A. Demkov, Electronic and optical properties of NbO_2, *J. Appl. Phys.* 116, 213705 (2014).

Briefly list the most recent professional development activities

- Regular attendee and participant at the annual section and national meetings of the American Physical Society (2014-2017)

Nuwanjula Samarasingha

Education – degree, discipline, institution, year

- Ph. D. Candidate, Physics, New Mexico State University, Las Cruces, NM, United States, 2015 January to present.
- M.S., Physics, New Mexico State University, Las Cruces, NM, United States (fall 2017 expected).
- B.S., Physics, University of Peradeniya, Sri Lanka, 2013.

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State University (NMSU), Department of Physics, Teaching assistant, January 2015 to present, part time.
- NMSU, Department of Physics, Research assistant, May 2015- June 2015, January 2017 – July 2017, part time.
- NMSU, Department of Physics, Instructor for Engineering and General Physics Lab - PHYS 216GL, PHYS 212GL, Summer -2016 and 2017.
- University of Peradeniya, Department of Physics, Teaching assistant, February 2013 – November 2014.

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- n.a.

Certifications or professional registrations

- n.a.

Current membership in professional organizations

- American Vacuum Society (AVS).
- American Physical Society (APS).

Honors and awards

- Best student presentation in Ellipsometry focus topic session -AVS 63rd International Symposium and Exhibition, Nashville, TN, 2016.
- Won 3rd place in oral presentation - AVS New Mexico Symposium, Albuquerque, NM, May 16th, 2017.

Service activities (within and outside of the institution)

- Volunteer judge for the Southwestern New Mexico Regional and Engineering Fair, Las Cruces, NM, 04 March 2017.
- Vice President of Physics Graduate Student Organization, New Mexico State University (2016- 2017).

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- T.N. Nunley, N.S. Fernando, N. Samarasingha, J.M. Moya, C.M. Nelson, A.A. Medina, S. Zollner, Optical constants of germanium and thermally grown germanium dioxide from 0.5 to 6.6 eV via a multi-sample ellipsometry investigation, J. Vac. Sci. Technol. B 34, 061205, 2016. DOI: 10.1116/1.4963075.

- T.N. Nunley, N.S. Fernando, N. Samarasingha, J.M. Moya, C.M. Nelson, A.A. Medina, S. Zollner, Precise optical constants of Ge and GeO_2 from 0.5 to 6.6 eV, IEEE Summer Topicals Conference on Emerging Technology for Integrated Photonics, July 2016, Newport Beach, CA. DOI: 10.1109/PHOSST.2016.7548738.
- Nuwanjula Samarasingha, Zachary Yoder, Stefan Zollner, Dipayan Pal, Aakash Mathur, Ajaib Singh, Rinki Singh, Sudeshna Chattopadhyay, Excitonic effects on the optical properties of thin ZnO films on different substrates, AVS 64th International Symposium & Exhibition, Tampa, Florida, October 30 – November 3, 2017.
- Nuwanjula Samarasingha, Cesar Rodriguez, Jaime Moya, Nalin Fernando, Stefan Zollner, Patrick Ponath, Kristy J. Kormondy, Alex Demkov, Dipayan Pal, Aakash Mathur, Ajaib Singh, Surjendu Dutta, Jaya Singhal, Sudeshna Chattopadhyay, Excitonic effect at interfaces in thin oxide films, AVS New Mexico Symposium, Albuquerque, NM, May 16th, 2017.
- Nuwanjula Samarasingha, Cesar Rodriguez, Jaime Moya, Nalin Fernando, Stefan Zollner, Patrick Ponath, Kristy J. Kormondy, Alex Demkov, Dipayan Pal, Aakash Mathur, Ajaib Singh, Surjendu Dutta, Jaya Singhal, Sudeshna Chattopadhyay, Excitons at interfaces in ellipsometric spectra, AVS 63rd International Symposium & Exhibition, Nashville, TN, 6-11, November 2016.
- Nuwanjula Samarasingha, Cesar Rodriguez, Jaime Moya, Nalin Fernando, Stefan Zollner, Patrick Ponath, Kristy J. Kormondy, Alex Demkov, Dipayan Pal, Aakash Mathur, Ajaib Singh, Surjendu Dutta, Jaya Singhal, Sudeshna Chattopadhyay, Excitons at interfaces in thin oxide films, APS Four Corners Section Meeting, Las Cruces, NM, 21-22 October 2016.
- N. Samarasingha, C. Rodriguez, J. Moya, S. Zollner, N. Fernando, S. Chattopadhyay, P. Ponath, and A.A. Demkov, Structural and optical properties of $SrTiO_3$ thin films on different substrates, Lawrence Symposium on Epitaxy, Scottsdale, AZ, 21-24 February 2016.
- N. Samarasingha, C. Rodriguez, J. Moya, S. Zollner, N. Fernando, S.Chattopadhyay, P. Ponath, and A.A. Demkov, Structural and optical properties of $SrTiO_3$ thin films on semiconductors, The 43rd Conference on the Physics and Chemistry of Surfaces and Interfaces, Palm Springs, CA, 17-21 January 2016.
- N. Samarasingha, J. Moya, S. Zollner, S. Chattopadhyay, P. Ponath, and A. Demkov, Structural properties of $SrTiO_3$ thin films on semiconductors, APS Four Corners Section Meeting, Tempe, AZ, 16 October 2015.

Briefly list the most recent professional development activities

- Regular attendee and participant at the annual AVS International Symposium and Exhibition (2016-2017).

Hasan Cavit Sezer

Education – degree, discipline, institution, year

- Ph. D student, New Mexico State University started in 2014
- M.S in Theoretical Physics, Stockholm University 2011
- B.S., Physics, Isik University, Turkey 2007

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State University, Physics, Teaching Assistant, 2014-2017, part time
- Istanbul Technical University, Department of Physics Engineering, part time

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

n.a

Certifications or professional registrations

- n.a.

Current membership in professional organizations

- n.a

Honors and awards

- Honor Student at Işık University 2003-2004,
- Scholarship By ÖSYM (Student Selection and Placement Center)

Service activities (within and outside of the institution)

- Research Assistant at Stockholm University 2010-2011, Quantum Information and Quantum Computation Group, Stockholm, Sweden

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

Briefly list the most recent professional development activities

- A Representation of Extraspecial 2-Group, Entanglement and Berry Phase of Two Qubits in a Yang-Baxter System, *J. of Quantum Information* **11**, Number 6 (2012) pp 1685-1694
- Quantum Entanglement Properties of Geometrical andTopological Quantum Gates (Advances in Quantum Theory: Proceedings of Int. Conf. on Advances in Quantum Theory. AIP Conference Proceedings, Volume 1327 (2011) pp, 472-476.
- Poster: H. Cavit Sezer, H. Ngoc Duy, Hoshang Heydari, Geometric Phases of different Classes of Four-Qubit States. (Advances in Quantum Theory Conference, Vaxjö University, June 2010)
- Poster: H. CavitSezer, Hoshang Heydari, Quantum Entanglement Properties of Geometrical and Topological Quantum Gates (Quantum Computation and Quantum Information Conference- Wenner Gren Center, Stockholm, October 2010)

Briefly list the most recent professional development activities

- n.a.

Samantha Sword-Fehlberg

Education – degree, discipline, institution, year

- Ph. D., Physics, New Mexico State University (NMSU), In Progress
- B.S., Physics and Astronomy, Northern Arizona University (NAU), 2016

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- NMSU, Department of Physics, Research Assistantship, 2017 – Present, Half time
- NMSU, Department of Physics, Graduate Assistantship, 2016 – 2017, Half time

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Center for Computing Excellence: HEP Fellowship Recipient, Fermi National Laboratory, Summer 2017, Full Time
- Air Force Research Laboratory (AFRL) Summer Scholar, Kirtland AFB, Albuquerque, NM, Summer 2016, Full time
- AFRL Summer Scholar, Kirtland AFB, Albuquerque, NM, Summer 2015, Full time
- Boston College Intern, Kirtland AFB, Albuquerque, NM, Winter 2014, Full time
- Boston College Intern, Kirtland AFB, Albuquerque, NM, Summer 2014, Full time

Certifications or professional registrations

- Secret Security Clearance granted by Federal Government
- Class IV Laser Usage through NAU and Federal Government
- Trained in traditional first aid as well as acute response techniques

Current membership in professional organizations

- American Physical Society (APS), 4-Corners Section
- Sigma Pi Sigma Physics Honor Society
- Optical Society of America

Honors and awards

- Received Position of Student at Large Member of Four-Corners Section of the American Physical Society , 2016
- Graduated with NAU Department Honors
- Member of NAU Dean's List for 5 Semesters
- NAU Department Scholarship for Academic Success, 2015-2016
- Recipient of Girl Scout Gold Award (equivalent to Eagle Scout), 2012

Service activities (within and outside of the institution)

- President of the Physics Graduate Student Organization, Fall 2017 – Present
- Student Member at Large of Four-Corners Section of the APS, 2016-Present
- Chair of the Spherical Cow Award Organizing Committee of the 2016 Joint Four-Corners/Texas Sections meeting of the APS, Fall 2016
- Volunteer Camp Counselor, Camp Mary White, 2013-2015

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Multi-Particle Identification Using Convolutional Neural Networks in Microboone, APS Four-Corners Section Meeting, Fort Collins, Colorado, October 21, 2017
- Efficient Coupling of a Super Continuum Laser to a Double Monochromator, Kirtland AFB (Talk, August 2015), NAU (Talk, Sep 2015), APS Four-Corners Section Meeting (Poster, October 2015)
- Spectral Calibration of Hyperspectral Imagers, Kirtland AFB (Talk, August 2014), NAU (Talk, September, 2014)

Briefly list the most recent professional development activities

- Regular attendee and participant at the annual 4-Corners Section meetings of the APS (2015-2017)

Engineering Physics Program

(Bachelor of Science in Engineering Physics)

at

New Mexico State University

Tenured & Tenure-Track Faculty – Department of Mechanical & Aerospace Engineering

Abdessattar Abdelkefi

Education – degree, discipline, institution, year

- Ph.D. in Engineering Mechanics, Virginia Polytechnic Institute and State University, (2012)
- MS in Mechanical Engineering, Tunisia Polytechnic School – Tunisia (2009)
- BS in Mechanics and Structures, Tunisia Polytechnic School – Tunisia (2009)

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- Assistant Professor (08/2014 – present), Department of Mechanical and Aerospace Engineering, New Mexico State University
- Postdoctoral Research Fellow (08/2012– 08/2014), Virginia Polytechnic Institute and State University
- Research/Teaching Assistant (01/2010– 07/2012), Virginia Polytechnic Institute and State University

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- none

Certifications or professional registrations

- none

Current membership in professional organizations

- American Institute of Aeronautics and Astronautics, AIAA
- American Society for Engineering Education, ASEE
- Member, Energy Harvesting Network, EPSRC

Honors and awards

- *Liviu Liberscu Memorial Scholarship* of the Department of Engineering Science and Mechanics at Virginia Tech, rewarded based on the criteria of *"having the potential for scholarly achievement in teaching and research, and a demonstrated dedication to the welfare and well-being of others.",* Spring 2011.
- *Bechtel Graduate Travel Fellowship "available on a yearly basis for ten EM doctoral students of the Department of Engineering Science and Mechanics at Virginia Tech",* Spring 2011.
- *Master degree top student award*, Summer 2009.
- *Best Engineering Internship Award,* Summer 2009.

Service activities (within and outside of the institution)

- Editorial Board: (1) Heliyon, (2) International Journal of Recent advances in Mechanical Engineering (IJMECH).
- Associate Editor: (1) Journal of Applied and Computational Mechanics, (2) Advances in Engineering Science and Technology, (3) Robotics & Automation Engineering Journal.

- Reviewer for two books proposals in Elsevier.
- Member of the Graduate committee of the Mechanical and Aerospace Engineering Department at NMSU.
- Member of the Faculty Advisory Committee on Technology (FACT) at NMSU.

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Hassanalian, M., Rice, D., and Abdelkefi, A., 2018, Evolution of space drones for planetary exploration: A review, *Progress in Aerospace Sciences, 97, 61-105.*
- Taylor, G., Ceballes, S., and Abdelkefi, A., 2018*,* Insights on the point of contact analysis and characterization of constrained pipelines conveying fluid. *Nonlinear Dynamics*, 1-15
- Hassanalian, M., Ben Ayed, S., Ali, M., Houde, P., Hocut, C., and Abdelkefi, A., 2018, Insights on the thermal impacts of wing colorization of migrating birds on their skin friction drag and the choice of their flight route, *Journal of Thermal Biology, 72, 81-93*.
- Larkin, K., Ghommem, M., and Abdelkefi, A., 2018, Significance of size dependent and material structure coupling on the characteristics and performance of nanocrystalline micro/nano gyroscopes, *Physica E Low-dimensional Systems and Nanostructures, 99, 169-181.*
- Salazar, R., Fuentes, V., and Abdelkefi, A., 2018, Classification of biological and bioinspired aquatic systems: a review, *Ocean Engineering, 148, 75-114.*
- Dai, H., Ceballes, S., Abdelkefi, A., Y. Hong, and Wang, L., 2018, Exact modes for post-buckling characteristics of nonlocal nanobeams in a longitudinal magnetic field*, Applied Mathematical Modelling, 55, 758-775.*
- Hassanalian, M., Throneberry, G., Ali, M., Ben Ayed, S., and Abdelkefi, A., 2018, Role of wing color and seasonal changes in ambient temperature and solar irradiation on predicted flight efficiency of the Albatross, *Journal of Thermal Biology, 71, 112-122.*
- Zimmerman, S. and Abdelkefi, A., 2017, Review of marine animals and bioinspired robotic vehicles: classifications and characteristics, *Progress in Aerospace Sciences*, *93, 95-119.*
- Abdelmoula, H., Sharpes, N., Abdelkefi, A., Lee, H. and Priya, S., 2017, Low-frequency Zigzag energy harvesters operating in torsion-dominant mode, *Applied Energy, 204, 413-419.*
- Ali-Akbari, H.R., Ceballes, S., and Abdelkefi, A., 2017, Geometrical influence of a deposited particle on the performance of bridged carbon nanotube-based mass detectors, *Physica E Low-dimensional Systems and Nanostructures, 94, 31-46.*
- Abdelmoula, H., Zimmerman, S., and Abdelkefi, A., 2017, Accurate modeling, comparative analysis, and performance enhancement of broadband piezoelectric energy harvesters with single and dual magnetic forces, *International Journal of Non-Linear Mechanics, 95, 355-363.*

Briefly list the most recent professional development activities

- n.a.

Terry W. Armstrong

Education – degree, discipline, institution, year

- Ph.D. in Aerospace Engineering, New Mexico State University –NM (2015)
- MS in Aeronautical Science, Embry-Riddle University– FL (2000)
- BS in Engineering Science, United States Air Force Academy – CO (1985)
- Formal military courses: Air Command & Staff College (1999), Squadron Officer School (1990), Safety Board President course, Government Flight Representative course, etc

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- Assistant Professor (01/2016 – present), Department of Mechanical and Aerospace Engineering, New Mexico State University

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Air Operations Manager (11/2013 – 01/2014) Global Military Experts Consulting - Kandahar Afghanistan
- Senior Analyst (11/2008 – 10/2009) Advanced Concepts Enterprises, Inc - Eglin AFB, FL
- Deputy Director/Director (10/2004 – 09/2006) Air Force Operational Test and Evaluation Center, Special Test Directorate - Kirtland AFB, NM
- Chief of Flight Safety (02/2002 – 10/2009) United States Air Forces Europe - Ramstein AB, GE
- Commander (07/1999 – 02/2002) Detachment , 85th Test and Evaluation Squadron - Tyndall AFB, FL
- Government Flight Representative (07/1998 – 07/1999) Defense Contract Management Agency - Kimhae, KR
- F-15 Instructor Pilot/Assistant Operations Officer (08/1995 – 07/1998) 95th Fighter Squadron - Tyndall AFB, FL
- F-15 Pilot/Chief of Training/Chief of Scheduling (06/1991 – 08/1995) 59th Fighter Squadron - Eglin AFB, FL
- T-38 Instructor Pilot (10/1986 – 10/1990) 80th Flying Training Wing - Sheppard AFB, TX

Certifications or professional registrations

- None

Current membership in profession organizations

- Order of Daedalians

Honors and awards

- 2018 NMSU Frank Bromilow Engineering Teaching Excellence
- Air Medal, Aerial Achievement Medal, various service medals, United States Air Force (1985-2006)

- Major Herschel H. Green Trophy, Order of Daedalians, 1997
- "Turkey Shoot" Top Flight, Lead, 95th Fighter Squadron, 1997
- Top Gun 97-1, 95th Fighter Squadron, 1997
- Top Flight 97-1, 95th Fighter Squadron, 1997
- Top Gun Wingman, 59th Fighter Squadron, 1993
- F-15 Outstanding Graduate, 325th Fighter Wing, 1991
- T-38 Instructor of the Quarter, 80th Flying Training Wing, 1989 & 1990
- Top T-38 Aircrew & Top Team Awards, Air Education and Training Command, Torchlight Competition, 1989
- T-38 Well Done Award, 80th Flying Training Wing, 1988
- Service activities (within and outside of the institution) –
- Pearson Publishing professional review of Moving Frames in Dynamics textbook
- Skoltech Russia Center for Design Review Committee
- Bechtel Nevada Test Site Senior Test & Evaluation Independent Review Committee
- Boy Scouts of America Eagle Badge Seminar
- 24 NMSU student letters of recommendation
- NMSU Air Force ROTC Keynote Speaker
- NMSU Air Force ROTC Engineering Lecture

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Correlation of Electrical and Mechanical Properties of Cracked Conductive Materials, 2015 UMI Publishing
- Electrical Impedance Changes Due to Cracks in Planar Conductive Elements (2015), Structural Health Monitoring
- Extension of Elasto-static and Resistive Cross-Property Connections to Impedence (2014), International Journal of Engineering Science
- Evaluation of Strength of Plane Microcracked Structural Elements (2014), International Journal of Fracture

Briefly list the most recent professional development activities

- none

Vimal Chaitanya

Education – degree, discipline, institution, year

- Ph.D. in Materials Science and Engineering, The Johns Hopkins University, 1984
- MS in Bioengineering, Clemson University, 1979
- BE in Mechanical Engineering, The M.S. University of Baroda, India, 1973

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- Professor (01/01/2017 – present), Department of Mechanical and Aerospace Engineering, New Mexico State University
- Professor and Vice President for Research - NMSU (07/2006 – 12/31/2016), Department of Mechanical and Aerospace Engineering, New Mexico State University
- Director, Advanced Materials Processing and Analysis Center (08/1998 – 06/2006), University of Central Florida
- Program Director Materials Science and Engineering Graduate Degrees (08/1999 – 06/2006), University of Central Florida
- Professor (08/1998 – 06/2006), University of Central Florida
- Associate Professor (08/1989 – 07/1998), University of Central Florida
- Assistant Professor (08/1984 – 07/1989), University of Central Florida

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Guest Scientist (08/1983 – 07/1984), National Bureau of Standards (Now NIST)
- Assistant Mechanical Engineer (08/1973 – 08/1977), The Gujarat State Fertilizers Corporation Limited, Baroda, India

Certifications or professional registrations

- Professional Engineer (PE), State of Florida, 1988 (currently inactive)

Current membership in profession organizations

- Association of the Public and Land Grant Universities APLU
- National Academy of Inventors NAI
- The Electrochemical Society ECS
- The American Society for Materials ASM

Honors and awards

- Research Achievement Award, University of Central Florida, 2003
- Excellence in Professional Service Award, University of Central Florida, 2002
- Member of President's Millionaire Club (for bringing >$1M in a year), 2001
- Nominated for the UCF Pegasus Professor Award, 2000, 2002
- UCF Leadership Award, 1999

Service activities (within and outside of the institution)

- Editorial Board, Journal of Innovation, National Academy of Inventors, 2010-present

- Executive Committee, Council on Research (COR), Association of the Public and Land Grant Universities (APLU), 2011-2016
- Vice-Chair, Dielectric Science and Technology, The Electrochemical Society, 2016-present
- Vice President, Arrowhead
- Member, New Mexico Council for Research and Development Collaboration, 2012-2106
- Member, Education Committee, The Electrochemical Society, 2010-present
- Member, Awards and Honors Committee, The Electrochemical Society, 2016-present.
- Chair, Summer Fellowship Program Committee, The Electrochemical Society, 2008-present

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- 1G. Chen, E. Fu, M. Zhou, Y. Xu. L. Fei, S. Deng, V. Chaitanya, Y. Wang and H. Luo. "A Facile Microwave-assisted Route to Co(OH)2 and Co3O4 Nanosheet for Li-ion Battery", J. of Alloys and Compounds, 578 (2013) 349-354
- Butler, B., Chopra, M.B., Kassab, A.J. and Chaitanya, V., Boundary Element Model for Electrochemical Dissolution under Externally Applied Low Level Stress Engineering Analysis with Boundary Elements, 37 (2013) 977-987
- Chaitanya, V., 232nd ECS Fall Meeting, The Electrochemical Society, National Harbor, MD, "Sustainable Autarky of Food-Energy-Water (SAFE-Water)", October 1-5, 2017
- Chaitanya, V. (Panelist and Speaker), Association of Public and Land Grant Universities – Council on Research, "Breaking down silos between research centers and academic units," July 9-11, 2017

Briefly list the most recent professional development activities

- Interim Director of Energy Research Lab, working on enhancing research in areas of Energy-Water nexus, Materials for Energy and Materials Degradation, 2017-present.
- Working with DOE-Los Alamos National Lab to foster a Regional Academic Collaboration (REACT) in STEM disciplines and address the workforce pipeline needs of the Nation while creating collaborative opportunities for Universities with Government Labs, 2017-present.
- Assisted in creating and administering interdisciplinary graduate degree programs (Masters and Ph.D.) in Water Science and Management at NMSU, 2012-2016.
- Created strategic initiative office in 2008, which was later renamed office of research development to align with the professional organization, NORDP.
- Created a user lab facility for NMSU researchers named CURRL (Core University Resource Research Laboratory) with a full time Director
- Participated in formulating and functioning of New Mexico Collaborative Research and Development Council (NMCRDC) working with the legislative staff of the congressional delegation to improve collaboration between universities, government labs and defense institutions within the state of NM.

Ruey-Hung Chen

Education – degree, discipline, institution, year

- Ph.D. in Aerospace Engineering, The University of Michigan – Ann Arbor (1988)
- MS in Aerospace Engineering, The University of Michigan – Ann Arbor (1984)
- BS in Aeronautical Engineering, National Cheng-Kung University – Taiwan (1981)

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- Robert G. Myers Professor and Department Head (01/2016 – present), Department of Mechanical and Aerospace Engineering, New Mexico State University full-time
- Associate Chair (08/03 – 08/06) and Graduate Coordinator (08/03 – 09/04 and 08/07 – 08/08), Department of Mechanical, Materials and Aerospace Engineering, University of Central Florida, Orlando, Florida
- Professor (08/2004 – 12/2015; on sabbatical leave, 08/2006 – 04/2007)
  Associate Professor (1998 – 2004), Assistant Professor (1993 – 1998)
  Department of Mechanical, Materials and Aerospace Engineering, University of Central Florida, Orlando, Florida

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Program Director (9/12 – 09/15) Combustion and Fire Systems Program
- Program Director (Acting) (08/14 – 08/15) Thermal Transport Processes Program
  National Science Foundation (NSF)
- Faculty Research Participant
  National Energy Technology Laboratory (NETL), Pittsburgh, PA (through Oak Ridge Institute for Science and Education; 11/06 – 07/07, 05/08 – 07/08, 04/09 – 06/11)
- Aerospace Engineer (08/1992 – 12/1992)
  AeroChem Research Laboratories, Princeton, New Jersey

Certifications or professional registrations

- none

Current membership in profession organizations

- American Society of Mechanical Engineers (ASME), the Combustion Institute, ASEE

Honors and awards

- Distinguished Alumnus Award, Institute of Aeronautics and Astronautics, National Cheng-Kung University, Taiwan (to receive on November 12, 2016)
- Excellence in Undergraduate Teaching Award, College of Engineering and Computer Science, University of Central Florida (UCF), 2012
- Best Paper Award, ASCE (American Society of Civil Engineers) Earth and Space 2010 Conference – "Study of Fire Retardant Performance of Composite Coated with Hybrid Carbon Nanofiber Papers"
- UCF Teaching Incentive Award for academic years 1998 – 2003

- (Florida) State University System/UCF/COE Teaching Incentive Award from 1994 – 98
- UCF MMAE Undergraduate Teaching Award (1996, 1998, 1999, 2009, 2012)
- UCF MMAE Graduate Teaching Award (1995, 2010)
- UCF MMAE Advising Award (2005)
- Achievement Award (25 awarded out of approx. 7,000 students), National Cheng-Kung University, Taiwan, 1980

Service activities (within and outside of the institution)

- Proposal reviewer/panelist, National Science Foundation
- Reviewer, Air Force Office of Scientific Research
- Reviewer – International journal of Heat and Mass Transfer, AIAA Journal of Thermophysics and Heat Transfer

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Y. Wei, F.S. Segura, W. Deng, and Ruey-Hung Chen (2018) Ignition of counter-flow diffusion flames: effect of diluents and diffusive-thermal properties, accepted for publication, International Journal of Heat and Mass Transfer, Vol. 123, 988-993.
- Foundations of Gas Dynamics – Cambridge University Press, 418 pp, April 2017 (ISBN 978-1-107-08270-0) (single author)
- R. Holguin, K. Kota, S. Wooten, Ruey-Hung Chen, S. Ross (2017) Enhanced boiling heat transfer on binary surfaces, International Journal of Heat and Mass Transfer, Vol. 114, 1105-1113.
- Y. Wei, W. Deng, and Ruey-Hung Chen (2016) Effects of internal circulation and particle mobility during nanofluid droplet evaporation, International Journal of Heat and Mass Transfer, Vol. 103, 1335-1347.
- Y. Wei, W. Deng, and Ruey-Hung Chen (2016) Effects of insoluble nano-particles on nanofluid droplet evaporation, International Journal of Heat and Mass Transfer, Vol. 97, 725-734.
- M. Robayo, B. Beaman, B Hughes, B. Delose, N. Orlovskaya, and Ruey-Hung Chen (2014) Perovskite catalyst enhanced combustion on porous media, Energy, Vol. 76, 477-486.
- M. Tsoi, J. Zhuge, Ruey-Hung Chen, and J. Gou (2014) Modeling and experimental studies of thermal degradation of glass fiber reinforced polymer composites, Fire and Materials, Vol. 38(2), 247-263.
- K. Mueller, O. Waters, V. Bubnovich, N. Orlovskaya, and Ruey-Hung Chen (2013) Super-adiabatic combustion in Al_2O_3 and SiC coated porous media for thermoelectric power conversion, Energy, Vol. 56, 108-116.
- Tran X. Phuoc and Ruey-Hung Chen (2013) Spontaneous ignition of low-concentration nano-sized Al-water slurry, Applied Energy, Vol. 101, 567-571.

Briefly list the most recent professional development activities

- AIAA Sci Tech Conference, Kisseemmee, FL, January 8-12, 2018
- ASEE Annual Conference, Columbus, OH, June, 2017

- NMSU Teaching Academy – Activities include Department Head Training, On-line Course Quality Matter Workshop

Vincent K. Choo

Education – degree, discipline, institution, year

- Ph.D., Composite Materials, 1982, Liverpool University, U.K.
- B.Sc., ME (Honors), 1977, Nottingham University, U.K.

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- Mech Engr, New Mexico State University, Associate Professor, Aug '92 - Present
- Mech Engr, New Mexico State University, Assistant Professor, May '85 - Aug '92
- Mech Engr, Univ of Washington, Seattle, Visiting Assistant Professor, Apr '83-Dec '84
- Imperial College, London, U.K., Postdoctoral Research Assistant, Oct-Dec 1982

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Consulting Experience:
- Turbo-Care, a subdivision of Westinghouse, Houston, USA, 2004
- Abitibi, Arizona, USA, 1999
- Summer Assignment, Boeing, Seattle, USA, 1998
- Crescent Consultants LTD., Nottingham, U.K., 1991
- Sund Defibrator AB, Stockholm, Sweden, 1985
- Boeing Airplane Company, Seattle, Washington, 1984
- 1983 - Flow Industries, Kent, Washington

Certifications or professional registrations

- none

Current membership in professional organizations

- none

Honors and awards

- none

Service activities (within and outside of the institution)

- ME, NMSU, ABET committee member
- ME, NMSU, Faculty Peer Review committee member
- Judging Panel:
- Science Fair, Desert Spring Christian School, January 13, 2017.
- Panel Review of Proposals:
- Proposal review for New Mexico Space Grants Consortium 2011
- NSF Instrumentation and Laboratory Improvement Program, 1993
- Book Review:
- Analytic Dynamics, MrGraw Hill, 1997

- Basic Mechanical Design, by J.E. Shingley McGraw-Hill, September, 1993

Briefly list the most recent professional development activities

- “On the Topic of Assessment and Evaluation”, ASEE Gulf Southwest Annual Conference, Bridging Theory and Practice in Engineering and Technology Education, UTEP, EL PASO, April 2012
- Workshop hosted by the NMSU Teaching Academy:
- 6/30/2011 - Documenting Effective Teaching in a Scholarly Manner. As a participant
- Seminar hosted by the NMSU Teaching Academy
- 10/13/2011 - How Good is Good Enough? Setting Assessment Benchmarks or Standards. As a participant

Edgar G. Conley

Education – degree, discipline, institution, year

- PhD. Engineering Mechanics, Michigan State University (MSU), East Lansing, MI, l986.
- MSME Machine Design, MSU, l979.
- BSME, MSU, l971.

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- Associate Professor, (1993-present) MAE Dept., New Mexico State University
- NASA Administrator's Faculty Fellow, (2008-2009, twelve-month appointment) John C. Stennis Space Center, MS Gulf Coast.
- Summer Faculty Research Fellow, (summer 1999) The Boeing Company, Seattle, WA.
- Summer Faculty Research Fellow (summers 1992 and 1993) supported by Associated Western Universities, Inc., at the DOE/Waste Isolation Pilot Plant, Carlsbad, NM
- Assistant Professor (1988 - 1993) Mechanical Engineering Department, New Mexico State.
- Assistant Professor (1986 - 1988), Mechanical Engineering Department, University of Alaska Fairbanks, Fairbanks, AK.

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Engineering Consultant (self-employed) - manufacturing, products liability/consulting, and criminal investigations

Certifications or professional registrations

- Registered Professional Engineer, Michigan, #6201025252

Current membership in profession organizations

- American Society of Mechanical Engineers (ASME)
- American Society of Engineering Education (ASEE)

Honors and awards

- Donald C. Roush Excellence in Teaching Award, NMSU Engineering College, 2012
- ASME Student Section Advisor for the Year, 2004 for Region XII
- Professor of the Year, Mechanical Engineering Academy, NMSU from 2000 and 2005

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Invited Workshop: "Hybrid Rocket Experiment Station," NASA Human Exploration and Operations Higher Education Project in partnership with the National Space Grant College and Fellowship Program Fourth Annual Space Grant Faculty Senior Design Training, Kennedy Space Center, FL, July 19&20 2012.

Briefly list the most recent professional development activities

- n.a.

Borys Drach

Education – degree, discipline, institution, year

- Ph.D. in Mechanical Engineering, University of New Hampshire – Durham (2013)
- Cognate in College Teaching, University of New Hampshire – Durham (2013)
- B.S. in Mechanical Engineering, National Technical University of Ukraine – Kyiv (2008)

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- Assistant Professor (08/2013 – Present), Department of Mechanical & Aerospace Engineering, New Mexico State University, Las Cruces NM
- Post-Doctoral Associate (05/2013 – 08/2013), Department of Mechanical Engineering, University of New Hampshire, Durham NH
- Research and Teaching Assistant (08/2008 – 05/2013), Department of Mechanical Engineering, University of New Hampshire, Durham NH

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Mechanical Engineering Intern (06/2012 – 08/2012), SynCardia Systems, Tucson AZ

Certifications or professional registrations

- none

Current membership in profession organizations

- United States Association for Computational Mechanics (USACM)
- International Association for Computational Mechanics (IACM)
- American Society of Mechanical Engineers (ASME)

Honors and awards

- J.T. Oden Faculty Fellow (2015), University of Texas at Austin
- Dissertation Year Fellowship Award (2012-2013), University of New Hampshire
- Golden Key International Honors Society Member (UNH Chapter)

Service activities (within and outside of the institution)

- Proposal reviewer/panelist, National Science Foundation
- Reviewer – International Journal of Solids and Structures; Engineering Fracture Mechanics; Journal of Manufacturing Processes; Advanced Engineering Materials; Acta Mechanica; Materials and Design; Mathematical Methods in the Applied Sciences; Composite Structures; Mechanics of Materials; ASME International Mechanical Engineering Congress & Exposition; International Conference on Composite Materials

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Drach, B., Tsukrov, I., Trofimov, A.*, Gross, T., Drach, A., 2018. "Comparison of stress-based failure criteria for prediction of curing induced damage in 3D woven composites". Composites: Part A, 189, 366-377
- Kuksenko, D.*, Drach, B., 2017. "Effective conductivity of materials with continuous curved fibers". International Journal of Engineering Science, 118, 70-81
- Kuksenko, D.*, Drach, B., Tsukrov, I., 2017. "Prediction of Damage Initiation and Simulation of Damage Propagation in 3D Woven Composites During Processing". Proceedings of the 32nd ASC Technical Conference, West Lafayette, IN, USA
- Trofimov, A.*, Drach, B., Sevostianov, I., 2017. "Effective elastic properties of composites with particles of polyhedral shapes". International Journal of Solids and Structures, 120, 157-170
- Trofimov, A.*, Drach, B., Kachanov, M., Sevostianov, I., 2017. "Effect of a partial contact between the crack faces on its contribution to overall material compliance and resistivity". International Journal of Solids and Structures, 108, 289-297
- Drach, B., Kuksenko, D.*, Sevostianov, I., 2016. "Effect of a curved fiber on the overall material stiffness". International Journal of Solids and Structures, 100-101, 211-222
- Drach, B., Tsukrov, I., Trofimov, A.*, 2016. "Comparison of full field and single pore approaches to homogenization of linearly elastic materials with pores of regular and irregular shapes". International Journal of Solids and Structures, 96, 48-63
- Tsukrov, I., Drach, B., Trofimov, A.*, 2015. "Comparison of Full Field and Single Inclusion Approaches to Homogenization of Composites with Non-Ellipsoidal Pores". Key Engineering Materials (Advances in Fracture and Damage mechanics XIII), 627, 309-312
- Sevostianov, I., Kachanov, M., Drach, B., 2014. "On the effect of interactions of inhomogeneities on the overall elastic and conductive properties". International Journal of Solids and Structures 51, 4531-4543
- Knezevic, M., Drach, B., Ardeljan, M., Beyerlein, I.J., 2014. "Three dimensional predictions of grain scale plasticity and grain boundaries using crystal plasticity finite element models". Computer Methods in Applied Mechanics and Engineering, 277, 239-259
- Drach, B., Drach, A., Tsukrov, I., 2014. "Prediction of the effective elastic moduli of materials with irregularly-shaped pores based on the pore projected areas". International Journal of Solids and Structures, 51, 2687-2695
- Drach, A., Drach, B., Tsukrov, I., 2014. "Processing of fiber architecture data for finite element modeling of 3D woven composites". Advances in Engineering Software, 72, 18-27
- Drach, B., Drach, A., Tsukrov, I., 2013. "Characterization and Statistical Modeling of Irregular Porosity in Carbon/Carbon Composites Based on X-Ray Microtomography Data". Journal of Applied Mathematics and Mechanics (ZAMM) 93, 346-366

Briefly list the most recent professional development activities

- NMSU Teaching Academy member (2013, 2014)

- NSF Workshops (Arlington VA, 2014; Lubbock TX, 2015)
- Summer Fellowship, University of Texas at Austin (2015)

Gabe Garcia

Education – degree, discipline, institution, year

- Ph.D. in Civil Engineering, Texas A&M University – (1996)
- MS in Mechanical Engineering, New Mexico State University – (1991)
- BS in Mechanical Engineering, New Mexico State University – (1988)

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- Interim Department Head (07/2015 – 01/16), Department of Mechanical and Aerospace Engineering, New Mexico State University, Las Cruces, NM
- Associate Chair (01/14 – 11/17), Department of Mechanical and Aerospace Engineering, New Mexico State University, Las Cruces, NM
- Associate Professor (2002 – present) and Graduate Coordinator (2003 – 2005) Assistant Professor (1996 – 2002)), Department of Mechanical and Aerospace Engineering, New Mexico State University, Las Cruces, NM

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Faculty Research Participant
  Space and Naval Warfare Systems Center – Pacific (SPAWAR), San Diego, CA
- (05/11 – 08/11, 05/12 – 08/12, 05/13 – 08/13)

Certifications or professional registrations

- none

Current membership in profession organizations

- American Society of Mechanical Engineers (ASME)

Honors and awards

- NMSU MAES Leadership Award 2016
- NMSU MAES Outstanding Professor Award

Service activities (within and outside of the institution)

- Proposal reviewer/panelist, National Science Foundation, (1999, 2002, 2003, 2004)
- Proposal reviewer/panelist, NASA, (2000, 2001)
- Reviewer – International Journal of Solids and Structures (2003)
- ASCE Journal of Structural Engineering (2004)

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Leslie, I. H., Garcia, G., and Murray, L., Improving Student Performance in Programming Courses through Unlimited Access to Computer and Software Resources, ASEE Annual Conference & Exposition, Portland, Oregon, June 2005.
- Riley, L. A., Nassersharif, B., Garcia, G., and Schaub, J., An Automated Testing and Classification System For Identifying Defects in Nuclear Steam Generator Tubes

Using a Learning Vector Quantization Neural Architecture, Proceedings of the 2003 Advanced Simulation Technologies Conference, Society for Computer Simulation International, Orlando, Florida, April 2003.

- Jayawardana, S., Garcia, G.V., Nakotte, N., Clausen, B., Bourke, M., Finite Element Modeling of Anisotropic Properties of Cu-Ag Metal Matrix Composites, IEEE Transactions on Applied Superconductivity, Vol. 10 (1), 2000.
- Matthews, L.K. and Garcia, G.V., Laser and Eye Safety in the Laboratory, IEEE Press, New York, 1995.

Briefly list the most recent professional development activities

- Faculty Research Participant (05/11 – 08/11)
  Space and Naval Warfare Systems Center – Pacific (SPAWAR), San Diego, CA
- Faculty Research Participant (05/12 – 08/12)
  Space and Naval Warfare Systems Center – Pacific (SPAWAR), San Diego, CA
- Faculty Research Participant (05/13 – 08/13)
  Space and Naval Warfare Systems Center – Pacific (SPAWAR), San Diego, CA

Andreas Gross

Education – degree, discipline, institution, year

- Dr. Eng. in Mechanical Engineering, RWTH Aachen University – Germany (2002)
- Diploma in Aerospace Engineering, University of Stuttgart – Germany (1997)

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- Assistant Professor (01/14 – present), Department of Mechanical and Aerospace Engineering, New Mexico State University, Las Cruces, New Mexico
- Assistant Research Professor (01/05 – 12/13), Department of Aerospace and Mechanical Engineering, University of Arizona, Tucson, Arizona
- Research Associate (01/01 – 12/04), Department of Aerospace and Mechanical Engineering, University of Arizona, Tucson, Arizona

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Summer Faculty Fellowships
  Air Force Research Laboratory (AFRL), Wright-Patterson Air Force Base, Ohio
- (05/14 – 07/14, 05/15 – 07/15, 05/16 – 07/16, 05/18-07/18)

Certifications or professional registrations

- none

Current membership in profession organizations

- American Institute of Aeronautics and Astronautics (AIAA)

Honors and awards

- Outstanding Research Professor Award, NMSU Mechanical and Aerospace Eng. Academy, 2018
- Patricia Christmore Faculty Teaching Award, NMSU, 2017
- Outstanding Professor Award, NMSU Mechanical and Aerospace Engineering Academy, 2017

Service activities (within and outside of the institution)

- Proposal reviewer/panelist, National Science Foundation
- AIAA Fluid Dynamics Technical Committee, Associate Member (2007-2009), Full member (2017-2020)
- Assistant Organizer of 38th and 39th AIAA Fluid Dynamics Conference and 9th AIAA Flow Control Conference

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Andreas Gross, M. Agate, J. Little, H. Fasel, (2018) Numerical Simulation of Wing Section Undergoing Plunging Motions at High Angles of Attack, AIAA Journal, accepted.

- Andreas Gross, C. Marks, R. Sondergaard, (2018) Local Linear Stability Analysis of Curved Turbulent Endwall Boundary Layer in Low-Pressure Turbine Cascade, AIAA Journal, accepted.
- Andreas Gross, C. Marks, R. Sondergaard, P. Bear, and J. Wolff, (2018) Experimental and Numerical Characterization of Flow through Highly Loaded Low-Pressure Turbine Cascade, Journal of Propulsion and Power, Vol. 34(1), 27-39.
- Andreas Gross, C. Marks, R. Sondergaard, (2017) Numerical Investigation of Low-Pressure Turbine Junction Flow, AIAA Journal, Vol. 55 (10), 3617-3621.
- Andreas Gross, H.F. Fasel (2016) Hybrid Turbulence Model Simulations of Partially Stalled Airfoil Flow, AIAA Journal, Vol. 54(4), 1220-1234.
- Andreas Gross, H.F. Fasel (2015) Hybrid Turbulence Model Simulations of Hemisphere-Cylinder Geometry, International Journal of Heat and Fluid Flow, Vol. 54, 28-38.
- Andreas Gross, H.F. Fasel, M. Gaster (2015) Criterion for Spanwise Spacing of Stall Cells, AIAA Journal, Vol. 53(1), 272-274.
- Andreas Gross, H.F. Fasel (2013) Numerical Investigation of Separation Control for Wing Section, International Journal of Flow Control, Vol. 5(3&4), 121-141.
- H.F. Fasel, F. Meng, E. Shams, Andreas Gross (2013) CFD Analysis for Solar Chimney Power Plants, Solar Energy, Vol. 98(Part A), 12–22.
- C. Brehm, Andreas Gross, H.F. Fasel (2013) Open-Loop Flow-Control Investigation for Airfoils at Low Reynolds Numbers, AIAA Journal, Vol. 51(8), 1843-1860.
- Andreas Gross, C. Jagadeesh, H.F. Fasel (2013) Numerical and Experimental Investigation of Unsteady Three-Dimensional Separation on Axisymmetric Bodies, International Journal of Heat and Fluid Flow, Vol. 44, 53–70.
- Andreas Gross, H.F. Fasel (2013) Numerical Investigation of Passive Separation Control for an Airfoil at Low-Reynolds-Number Conditions, AIAA Journal, Vol. 51(7), 1553-1565.
- Andreas Gross, H.F. Fasel, (2012) Flow Control for NREL S822 Wind Turbine Airfoil, AIAA Journal, Vol. 50(12), 2779-2790.

Briefly list the most recent professional development activities

- Attended summer AIAA Fluid Dynamics/Flow Control conferences in summer and AIAA Scitech conferences in winter for last 20 years.

Krishna Kota

Education/Professional Preparation

- Postdoctoral Research Fellow, Georgia Institute of Technology – Atlanta (2008 – 2010)
- Ph.D. in Mechanical Engineering, University of Central Florida – Orlando (2008)
- M.S. in Mechanical Engineering, University of Central Florida – Orlando (2005)
- B.Tech. in Mechanical Engineering, Jawaharlal Nehru Tech. University – India (2002)

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- Assistant Professor (08/2012 – present), Department of Mechanical and Aerospace Engineering, New Mexico State University, Las Cruces, New Mexico
- Postdoctoral Research Fellow (08/2008 – 07/2010), Georgia Institute of Technology, Atlanta, Georgia

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Research Scientist (8/2010 – 08/2012), Bell Labs, Murray Hill, New Jersey

Certifications or professional registrations

- None

Current membership in profession organizations

- American Society of Mechanical Engineers (ASME), American Institute of Aeronautics & Astronautics (AIAA), American Society for Engineering Education (ASEE)

Honors and awards

- NMSU MAE Academy Professor; NMSU Donald Roush Faculty Award; Plenary Speaker at an international electronics cooling workshop, 2017 (invited); Review Editor for the journal 'Frontiers in Mechanical Engineering' (invited); Who's Who in Thermal Fluids; Mini-Symposium Organizer at ThermaComp Conference, 2016 (invited); The National Scholars Honor Society

Service activities (within and outside of the institution)

- Proposal reviewer/panelist for National Science Foundation and Oak Ridge Associated Universities; Reviewer for 16 international journals and 4 annual international conferences in the thermal sciences area; Served on the committees of international conferences in various roles

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Jessica Reyes, Krishna Kota, "Convective Performance of a Dielectric Liquid in a Channel with Conducting-Lubricating Walls for Liquid Cooling of Electronics," International Communications in Heat and Mass Transfer, Vol. 89, No. 12, pp. 147-153, 2017.
- Roberto Venegas, Sarada Kuravi, Krishna Kota, Mary McCay, "Comparative Design

Analysis of Geothermal and Solar Thermal Power Plants: A Case Study," International Journal of Renewable Energy Research, Vol. 7, No. 4, 2017 (in editing).

- Seyedali Seyedkavoosi, Saeed Javan, Krishna Kota, "Exergy-based Optimization of an Organic Rankine Cycle (ORC) for Waste Heat Recovery from an Internal Combustion Engine (ICE)," Applied Thermal Engineering, Vol. 126, No. 11, pp. 447-457, 2017.
- Ryan Holguin, Krishna Kota, Stephen Wootton, Ruey-Hung Chen, Sean Ross, "Enhanced Boiling Heat Transfer on Binary Surfaces," International Journal of Heat and Mass Transfer, Vol. 114, No. 11, pp. 1105-1113, 2017.
- Nicholas Clegg, Krishna Kota, Xin He, Sean Ross, "Achieving Ultra-Omniphilic Wettability on Copper using a Facile, Scalable, Tuned Bulk Micromanufacturing Approach," ASME Journal of Micro- and Nano-Manufacturing, Vol. 5, No. 3, 031003 (1-7), 2017.
- Krishna Kota, Ludovic Burton, Yogendra Joshi, "Thermal Performance of an Air-cooled Heat Sink Channel with Microscale Dimples under Transitional Flow Conditions," ASME Journal of Heat Transfer, Vol. 135, No. 11, 111005 (1-9), 2013.
- Jason Shelby, Krishna Kota, "Design of a High-effective, Compact Wavy Cryogenic Heat Recuperator," Proceedings of 2015 ASME International Mechanical Engineering Congress and Exposition, Houston, TX, November 14-20, 2015.
- Mohamed El-Genk, Arthur Suszko, Krishna Kota, "Nucleate Boiling of PF-5060 on Inclined Dimpled Surfaces," Proceedings of the 1st ASTFE Thermal and Fluid Engineering Summer Conference, New York, NY, August 9-12, 2015.
- Krishna Kota, Mohamed Awad, "Understanding the Impact of Flow Bypass on the Heat Transfer Performance of Air-Cooled Heat Sinks," Proceedings of 2014 ASME International Mechanical Engineering Congress and Exposition, Montreal, Canada, November 14-20, 2014.
- Krishna Kota, Mohamed Awad, "Understanding the Impact of Flow Bypass on the Overall Pressure Drop of Air-Cooled Heat Sinks," Proceedings of 2014 IEEE Intersociety Conference on Thermal and Thermomechanical Phenomena in Electronic Systems, Orlando, Florida, May 27-30, 2014.

Patents & Patent Applications in the Past Five Years

- An Approach for Altering Wetting Properties of Metallic Surfaces, Inventor: Krishna Kota (submitted, 2017).
- Cryogenic Heat Exchanger, Inventor: Krishna Kota (submitted, 2016).
- A Real-time Feedback Control System for Data Center Cooling, Co-Inventor: Krishna Kota (submitted, 2013).
- Cooling Technique, Co-Inventor: Krishna Kota, US 9,557,118.
- A Mechanically-reattachable Liquid-cooled Cooling Apparatus, Co-Inventor: Krishna Kota, US 8,542,489.

Briefly list the most recent professional development activities

- NMSU Teaching Academy Mentoring Program & Writing Workshops, Lab Safety Training, Radiation Safety Training, PI Training, Technical Conference Session/Topic Chair

Sarada Kuravi

Education – degree, discipline, institution, year & Training

- Postdoctoral Fellow, Clean Energy Research Center, University of South Florida – Tampa (2012)
- Ph.D. in Mechanical Engineering, University of Central Florida - Orlando (2009)
- M.S. in Mechanical Engineering, University of Central Florida - Orlando (2006)
- B.Tech. in Mechanical Engineering, Jawaharlal Nehru Technological University - India (2002)

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- Assistant Professor (08/2014 – present), Department of Mechanical and Aerospace Engineering, New Mexico State University, Las Cruces, New Mexico
- Assistant Professor (08/2012 – 05/2014), Department of Mechanical and Aerospace Engineering, Florida Institute of Technology, Melbourne, Florida
- Postdoctoral Research Fellow (09/2009 – 07/2012), Clean Energy Research Center, University of South Florida, Tampa, Florida
- Postdoctoral Research Fellow (08/2009 – 09/2009), Department of Mechanical, Materials and Aerospace Engineering, University of Central Florida, Orlando, Florida

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- CAD Engineer (2002 – 2003)
  Caltech Engineering Company Private Limited, India

Certifications or professional registrations

- None

Current membership in profession organizations

- American Society of Mechanical Engineers (ASME)
- International Solar Energy Society (ISES)
- American Institute of Aeronautics & Astronautics (AIAA)
- Society of Women Engineers (SWE)

Honors and awards

- ASME Florida Tech. Chapter Best Professor, Graduate Travel Award, Tau Beta Pi, National Scholars Honor Society

Professional Service activities (within and outside of the institution)

- Proposal reviewer/panelist, National Science Foundation, Department of Energy
- Reviewer, 13 international journals in the areas of thermal sciences and renewable energy, 2 annual international conferences from 2011
- Track and Session Organizer for ASME Power and Energy Conference and ASME IMECE

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Roberto Venegas, Sarada Kuravi, Krishna Kota, Mary McCay, "Comparative Design Analysis of Geothermal and Solar Thermal Power Plants: A Case Study," International Journal of Renewable Energy Research, Vol.8, No.1, March, 2018.
- Shahin Shafiee, Mary McCay, Sarada Kuravi, "The Effect of Magnetic Field on Thermal-Reaction Kinetics of a Paramagnetic Metal Hydride Storage Bed", Applied Sciences, Vol: 7, pp: 1006, 2017. doi:10.3390/app7101006.
- Shahin Shafiee, Mary McCay, Sarada Kuravi, "Effect of Magnetic Fields on Thermal Conductivity in a Ferromagnetic Packed Bed", Experimental Thermal and Fluid Science, Vol: 86, pp: 160-167, 2017. https://doi.org/10.1016/j.expthermflusci.2017.04.014
- Sesha Srinivasan, Arunachalanadar M. Kannan, Nikhil Kothurkar, Yehia Khalil, and Sarada Kuravi, "Nanomaterials for Energy and Environmental Applications", Journal of Nanomaterials, Article ID 979026, 2015. doi:10.1155/2015/979026
- Haibao Hu, Sarada Kuravi, Feng Ren, Pei-feng Hsu, "Liquid Metal Flow in Manifold Microchannel Heat Sinks", Proceedings of the International Mechanical Engineering Congress and Exposition, Montreal, Canada, November 14-20, 2014.
- Peijie Li, Sarada Kuravi, "Convective Performance of EPCM Slurries of Water, PAO and Engine Oil in Microchannels", Proceedings of the 10th International Conference on Heat Transfer, Fluid Mechanics and Thermodynamics, Orlando, FL, July 14-16, 2014.
- Peijie Li, Sarada Kuravi, "Study of Thermal Performance of Liquid Flow through a Minichannel", Proceedings of International Conference on Research and Innovations in Mechanical Engineering (ICRIME 2013), Ludhiana, India, October 24-26, 2013.
- Sarada Kuravi, Jamie Trahan, Yogi Goswami, Elias Stefanakos, Muhammad Rahman, "Thermal Energy Storage Technologies and System Design for Concentrating Solar Power Plants", Progress in Energy and Combustion Science, Vol: 39, No: 4, pp: 285-319, 2013.
- Sarada Kuravi, Jamie Trahan, Yogi Goswami, Chand Jotshi, Elias Stefanakos, Nitin Goel, "Investigation of a High Temperature Packed Bed Sensible Heat TES System with Large Sized Elements", Journal of Solar Energy Engineering, Vol: 135, No: 4, pp: 041008, 2013.
- Rachana Vidhi, Sarada Kuravi, Yogi Goswami, Elias Stefanakos, Adrian Sabau, "Organic Fluids in a Supercritical Rankine Cycle for Low Temperature Power Generation", Journal of Energy Resources and Technology, Vol: 135, No: 4, pp: 042002(9 pages), 2013.
- Sarada Kuravi, Yogi Goswami, Elias Stefanakos, Manoj Ram, Chand Jotshi, Swetha Pendyala, Jamie Trahan, Prashanth Sridharan, M. Rahman, B. Krakow, "Thermal Energy Storage for Concentrating Solar Power Plants", Technology and Innovation, Journal of the National Academy of Inventors, Vol: 14, No. 2, 2012.
- Dervis Demirocak, Sarada Kuravi, Manoj Ram, Chand Jotshi, Sesha Srinivasan, Ashok Kumar, D. Yogi Goswami, Elias Stefanakos, "Investigation of Polyaniline Nanocomposites and Cross-Linked Polyaniline for Hydrogen Storage", Advanced Materials Research, Vol: 445, pp: 571-576, 2012.

Briefly list the most recent professional development activities

- NMSU Teaching Academy Mentoring Program, PI Training, Lab Safety Training, ABET Thermodynamics Syllabus committee, Faculty Mentor - NM Pre-Freshman Engineering Program (PREP) Academy & Women in STEM Discovering Diversity Program

Young Sup Lee

Education – degree, discipline, institution, year

- Ph.D. in Mechanical Engineering, University of Illinois at Urbana-Champaign (2006)
- MS in Mechanical Engineering, Inha University, South Korea (1995)
- BS in Mechanical Engineering, Inha University, South Korea (1993)

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- Associate Professor (08/2014-present), Department of Mechanical and Aerospace Engineering, New Mexico State University
- Assistant Professor (08/2008-08/2014), Department of Mechanical and Aerospace Engineering, New Mexico State University
- Visiting Scholar (01/2011-12/2013), Department of Aerospace Engineering, University of Illinois at Urbana-Champaign
- Postdoctoral Research Associate / Visiting Assistant Professor (09/2006-08/2008), Departments of Mechanical Science and Engineering, and of Aerospace Engineering, University of Illinois at Urbana-Champaign
- Lecturer (03/2001-07/2002), Departments of Electrical, Electronic, and Control Engineering; and of Mechanical Engineering

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Consultant (06/2013-03/2014) Mitsubishi Electric Research Laboratories (MERL), Inc., Boston, MA
- Founding Member of International Joint Research Center for Innovative Technology in Acoustics and Vibrations (12/2012-present)
- R & D Engineer (07/1995-01/2001), Environmental Department, Kumho Institute of Construction Technology, South Korea; and Research and Development Center, Choongwae Medical Corporation, South Korea

Certifications or professional registrations

- None

Current membership in profession organizations

- American Society of Mechanical Engineers (ASME); American Institute of Aeronautics and Astronautics (AIAA); Society for Experimental Mechanics (SEM)

Honors and awards

- Distinguished Alumnus Award, Institute of Aeronautics and Astronautics, National Cheng-Kung University, Taiwan (to receive on November 12, 2016)
- Research Achievement Award, NMSU President and VPR, 2014.
- Outstanding Professor Award, NMSU MAE Academy, 2014.
- Institutions 2011 Thomas Bernard Hall Prize, Institution of Mechanical Engineers, 2011.
- 2008 Professional Engineering (PE) Publishing Award, Lee et al., Institution of

Mechanical Engineers, 2009.

- Mavis Memorial Fund Fellowship, College of Engineering, University of Illinois at Urbana-Champaign, 2005-2006.
- Special Graduate Scholarship and Chungseok Admission Scholarship, Inha University, 1989 and 1994-1995.

Service activities (within and outside of the institution)

- Proposal reviewer/panelist, National Science Foundation
- Conference Symposium Organizer/Co-organizer – ASME International Design Engineering Technical Conferences (IDETC) and Computers and Information in Engineering Conference (CIE), 2012-2016, 2018; EUROMECH European Nonlinear Dynamics Conference (ENOC 2014)
- Conference Chair/Co-Chair - ASME International Design Engineering Technical Conferences (IDETC) and Computers and Information in Engineering Conference (CIE), 2011-2016, 2018; 7th EUROMECH European Nonlinear Dynamics Conference (ENOC 2011); IMAC-XXXI Conference and Exposition on Structural Dynamics, 2013
- Journal Referee Activities - ASME Journals (Journal of Applied Mechanics; Journal of Vibration and Acoustics; Journal of Dynamic Systems, Measurement and Control; Journal of Computational and Nonlinear Dynamics; and Applied Mechanics Reviews); AIAA Journal; Journal of Fluids and Structures; Journal of Sound and Vibration; Mechanical Systems and Signal Processing; International Journal of Non-Linear Mechanics; Nonlinear Dynamics; Journal of Vibration and Control

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Nankali, A., Lee, Y.S., and Kalmar-Nagy, T., Targeted energy transfers for suppressing regenerative machine tool vibrations, ASME Journal of Computational and Nonlinear Dynamics, 12 (1), 011010-1-11, 2017.
- Pak, C.H., and Lee, Y.S., Bifurcation of coupled-mode responses by modal coupling in cubic nonlinear systems, Quarterly of Applied Mathematics, LXXIV(1), 1-26, 2016.
- Xu, M., Wei, M., Yang, T., and Lee, Y.S., An embedded boundary approach for the simulation of a flexible flapping wing at different density ratio, European Journal of Mechanics B/Fluids, 55, 146-156, 2016.
- Chen, H., Kurt, M., Lee, Y.S., McFarland, D.M., Bergman, L.A., and Vakakis, A.F., Experimental system identification of the dynamics of a vibro-impact beam with a view towards structural health monitoring and damage detection, Mechanical Systems and Signal Processing, 46, 91-113, 2014.
- Kurt, M., Chen, H., Lee, Y.S., McFarland, D.M., Bergman, L.A., and Vakakis, A.F., Nonlinear system identification of the dynamics of a vibro-impact beam: Numerical results,' Archive of Applied Mechanics, 82 (10), 1461-1479, 2012.

Briefly list the most recent professional development activities

- ASME International Design Engineering Technical Conferences (IDETC) and Computers and Information in Engineering Conference (CIE), 2012-2016, 2018

Hyeongjun Park

Education – degree, discipline, institution, year

- Ph.D. in Aerospace Engineering, The University of Michigan – Ann Arbor (2014)
- M.S. in Aerospace Engineering, Seoul National University – Republic of Korea (2008)
- B.S. in Mechanical and Aerospace Engineering, Seoul National University – Republic of Korea (2003)

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- Assistant Professor (01/2018 – present), Department of Mechanical and Aerospace Engineering, New Mexico State University, Las Cruces, New Mexico
- Postdoctoral Research Associate (05/2015 – 12/2017), Department of Mechanical and Aerospace Engineering, Naval Postgraduate School, Monterey, California
- Postdoctoral Researcher (06/2014 – 04/2015), Department of Aerospace Engineering, University of Michigan, Ann Arbor, Michigan

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Intern (05/2011 – 08/2011)
- Research & Innovation Center, Ford Motor Company, Dearborn, Michigan
- Associate Engineer (02/2008 – 07/2009)
  Mechanical Engineering Department, Samsung Engineering Co. Ltd., Seoul, Republic of Korea
- First Lieutenant (03/2003 – 02/2005)
  Infantry Platoon Leader, Republic of Korea Marine Corps, Pohang, Republic of Korea

Certifications or professional registrations

- None

Current membership in profession organizations

- American Institute of Aeronautics and Astronautics (AIAA), American Society of Mechanical Engineers (ASME), Institute of Electrical and Electronics Engineers (IEEE)

Honors and awards

- Postdoctoral Research Fellowship, U.S. National Research Council (2015, 2016, 2017)
- Best Paper Award, 6th International Conference of Astrodynamics Tools and Techniques (ICATT) Darmstadt, Germany – "Experimental Evaluation of Model Predictive Control and Inverse Dynamics Control for Spacecraft Proximity and Docking Maneuvers", 2016
- Second Placed Winner, Team Manager of Seoul National University Small Satellite

Team, 9th ARLISS Competition, Comeback Mission Competition of International Student Satellites Blackrock Desert, NV, 2007

Service activities (within and outside of the institution)

- Review Editor for Space Robotics Section of
- Frontiers in Astronomy and Space Sciences
- Frontiers in Robotics and AI
- Reviewer – IEEE Transaction on Control Systems Technology, International Journal of Robust and Nonlinear Control, Journal of Guidance, Control, and Dynamics, Mechanical Systems and Signal Processing, International Journal of Adaptive Control and Signal Processing, Advances in Space Research, Acta Astronautica, Journal of Intelligent and Robotics Systems

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- C. Zagaris, H. Park, J. Virgili-Llop, R. Zappulla, I. Kolmanovsky, and M. Romano (2018) Model Predictive Control of Spacecraft Relative Motion with Convexified Keep-Out-Zone Constraints, Journal of Guidance, Control, and Dynamics, accepted.
- M. Mammarella, E. Capello, H. Park, G. Guglieri, and M. Romano (2018) Classical and Robust Model Predictive Control for Spacecraft Rendezvous and Proximity Operations with Additive Disturbance, Aerospace Science and Technology, accepted.
- R. Zappulla, H. Park, J. Virgili-Llop, M. Romano (2018) Real-time autonomous spacecraft rendezvous and docking using an adaptive artificial potential field approach, IEEE Transactions on Control Systems Technology, accepted.
- R. Zappulla, J. Virgili-Llop, C. Zagaris, H. Park, A. Sharp, M. Romano (2017) POSEIDYN test bed: Experimental evaluation of autonomous spacecraft proximity operations and maneuvers, AIAA Journal of Spacecraft and Rockets, Vol. 54, No. 4, pp. 825-839.
- J. Virgili-Llop, C. Zagaris, H. Park, R. Zappulla, M. Romano (2017) Experimental evaluation of model predictive control and inverse dynamics control for spacecraft proximity and docking maneuvers, CEAS Space Journal, pp. 1–13, Invited Paper.
- H. Park, J. Sun, S. Pekarek, P. Stone, D. Opila, R. Meyer, I. Kolmanovsky, R. DeCarlo (2015) Real-time model predictive control for shipboard power management using the IPA-SQP approach, IEEE Transactions on Control Systems Technology, Vol. 23, No. 6, pp. 2129–2143.
- S. Di Cairano, H. Park, I. Kolmanovsky (2012) Model predictive control approach for guidance of spacecraft rendezvous and proximity maneuvering, International Journal of Robust and Nonlinear Control, Vol. 12, No. 4, pp. 1398–1427.

Briefly list the most recent professional development activities

- NMSU Teaching Academy Training Course (Spring, 2018)
- Strategies for Developing Competitive Proposals
- Publish & Flourish: Become a Prolific Scholar

Young Ho Park

Education – degree, discipline, institution, year

- Ph.D. in Mechanical Engineering, University of Iowa – Iowa City (1994)
- MS in Mechanical Design & Production Engineering, Seoul National University – Seoul (1988)
- BS in Mechanical Engineering, Seoul National University – Seoul (1986)

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- Associate Professor (2006 – present), Department of Mechanical and Aerospace Engineering, New Mexico State University, Las Cruces, New Mexico
- Assistant Professor (2000-2005), Department of Mechanical and Aerospace Engineering, New Mexico State University, Las Cruces, New Mexico
- Adjunct Assistant Professor (1999-2000), Mechanical Engineering Department, University of Iowa, Iowa City

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Research Scientist (1996-2000), Center for Computer-Aided Design, University of Iowa, Iowa City
- Research Engineer (1994-1996), Ford Motor Company, Dearborn, Michigan

Current membership in profession organizations

- American Society of Mechanical Engineers (ASME)

Honors and awards

- Synergy Teaching-Research-Serve Award, College of Engineering, New Mexico State University, 2017
- Certificate of Recognition, ASME Pressure Vessel and Piping Division, 2014
- Certificate of Appreciation, ASME Journal of Pressure Vessel Technology, 2012
- Outstanding Conference Paper Award, ASME Pressure Vessel and Piping Division, 2010
- Best Poster Award, 1st National Capstone Design Conference, 2007
- ME Academy Professor of the Year Award, Mechanical Engineering Academy, 2004
- Outstanding Teacher, NMSU ASME/Pi Tau Sigma Student Chapters, 2003
- Mechanical Engineering Innovative Teaching Award, New Mexico State University, 2003
- Outstanding Faculty, NMSU ASME/Pi Tau Sigma Student Chapters, 2001

Service activities (within and outside of the institution)

- Mechanical & Aerospace Engineering Graduate Program Director (2015-present)
- Faculty advisor, Research in Sustainable Technology (RIST) Club (2014 -)
- Academic advisor in undergraduate advising, Mechanical & Aerospace Engineering Department (2005-2016)
- Faculty advisor, Mechanical Engineering Competition Club (2004-2008)

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- C. Florez, Y. H. Park, D. Valles-Rosales, A. Lara and E. Rivera (2017) Removal of Uranium from Contaminated Water by Clay Ceramics in Flow-Through Columns, Water, Vol. 9(10), 761.
- Y.H. Park and I. Hijazi (2017), Development of Physics Based Analytical Interatomic Potential for Palladium-Hydride, J. of Molecular Modeling, Vol. 23:108.
- I. Hijazi and Y.H. Park (2016) A Mixed Intermetallic Potentials for Fe-Cu Compounds, Molecular Simulation, Vol. 42 (8), pp. 611-617.
- C. Lee, C. Gillum, K. Toupin, Y. H. Park (2016) B. Donaldson, Environmental performance assessment of utility boiler energy conversion systems, Energy Conversion and Management, Vol. 120, pp. 135-143.
- Y.H. Park, G. Smith, E. Park (2016) Mediator-less microbial fuel cell employing Shewanella oneidensis. Energy Sources, Part A: Recovery, Utilization, and Environmental Effects, Vol. 38 (12), pp. 1779-1784.
- Alnemrat, S., Park, Y. H., Vasiliev (2014) I. Ab initio study of ZnSe and CdTe semiconductor quantum dots. Physica E:Low-Dimensional Systems and Nanostructures, Vol. 57, pp. 96-10.
- Y. H. Park and I. Hijazi (2013) Structural, electronic, and magnetic properties of 22, 35, and 55-atom core-shell Au-Cu nanoclusters, Molecular Simulation, Vol. 39, No. 6, pp. 505-512.
- Y.H. Park and I. Hijazi (2012) Critical Size of Transitional Copper Clusters for Ground State Structure Determination: Empirical and Ab Initio Study, Molecular Simulation, Vol. 38, No. 3, pp. 241-247

Briefly list the most recent professional development activities

- FERPA Training for NMSU Student System/Data Access (2017)
- Basic Radiation Safety Training (2015)
- Hazardous Waste Management Training (2015)
- NIH Protecting Human Research Participants Training (2015)
- Hazardous Communication (HazCom) training (2014)

Igor Sevostianov

Education – degree, discipline, institution, year

- Ph.D. in Solid Mechanics, St. Petersburg State University (Russia) (1993)
- BS/MS in Solid Mechanics, St. Petersburg State University (Russia) (1989)

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- D. L. and A. Chapman Distinguished Professor (2014 – present)
- Professor (2015 – present)
- Associate Professor (2006 – 2015)
- Assistant Professor (2001 – 2006)
- Graduate Coordinator (2008 – 2013), Mechanical and Aerospace Engineering
- Academy Professor (2012-2014) Department of Mechanical and Aerospace Engineering, New Mexico State University, Las Cruces, NM.
- Senior Research Associate (1998 – 2001) Department of Mechanical Engineering, Tufts University, Medford, MA.
- Senior Research Associate (1997-1998) Department of Mechanical Engineering, University of Natal, Durban, South Africa.
- Visiting Scientist (1993-1996) Max-Planck Research Group "Mechanics of Heterogeneous Solids", Dresden, Germany.
- Visiting Professor BAM, Berlin, Germany (summers of 2016, 2017); University of Modena and Reggio Emilia, Italy (summers of 2014, 2015); TU Vienna, Austria, (2013, sabbatical); University of Lorrain, Nancy, France (summer 2012).

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Consultant New England Research Inc, (White River, VT), (2006); ALSTOM Power Inc., Zurich, Switzerland (2002-2004); General Electric Corporate R&D, Schenectady, NY (2001-2002).

Certifications or professional registrations

- None

Current membership in profession organizations

- ASME, SES

Honors and awards

- US Department of State Fulbright Professor 2012-2013
- Journal of Thermal Spray Technology 2009 best paper award.
- Elsevier award for authorship of the most cited paper in the IJSS during 2005-2008.
- NMSU Research Council Award for Achievements in Scholarly Activity, 2006.
- NMSU ME Academy Professor of the Year, 2007.

Service activities (within and outside of the institution)

- Member of the editorial boards: International Journal of Engineering Science (Elsevier); Mathematical Methods in the Applied Sciences (Wiley); International

Journal of Theoretical and Applied Multiscale Mechanics (Inderscience); Nanomechanics Science and Technology (Begell); International Journal of Materials (NAUN); International Journal of Mechanics (NAUN); Journal of the Computational Engineering (Hindawi); World Journal of Methodology (Baishideng); Acta Mechanica et Automatica (Poland); Journal of Applied and Computational Mechanics (Iran); Vestnik of DSTU (Russia); Scientific Letters of Rzeszow University of Technology (Poland).

- Member of the best paper award committee: Journal of Thermal Spray Technology
- Reviewer for scientific journals and publishing companies on mechanics of materials – 35-45 papers and 1-2 books per year.

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Kachanov, M. and Sevostianov, I. Micromechanics of Materials, with Applications, Springer, 2018. ISBN 978-3-319-76204-3
- Kachanov, M. and Sevostianov, I. Effective properties of heterogeneous materials, Springer, 2013. ISBN 978-94-007-5714-1
- Sevostianov, I. On the shape of effective inclusion in the Maxwell homogenization scheme for anisotropic elastic composites. Mechanics of Materials 75 (2014) 45-59.
- Sevostianov, I. On the thermal expansion of composite materials and cross-property connection between thermal expansion and thermal conductivity, Mechanics of Materials, 45 (2012) 20-33.
- Sevostianov, I. and Kachanov, M. Connections between elastic and conductive properties of heterogeneous materials, Advances in Applied Mechanics, 42, (2009), 69-252.

Briefly list the most recent professional development activities

- Member of NMSU Teaching Academy.
- NSF Workshop for teaching solid mechanics courses for undergraduate students
- NSF QEM Workshop for Underrepresented Minority Engineering & Materials Science Graduate Students and Senior Faculty/Advisors

Banavara Shashikanth

Education – degree, discipline, institution, year

- Ph.D. in Aerospace Engineering, University of Southern California (1998)
- M. E. in Aerospace Engineering, Indian Institute of Science, Bangalore--India (1991)
- B. Tech in Aerospace Engineering, Indian Institute of Technology, Madras--India (1989)

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- Associate Professor (2010 – present), Department of Mechanical and Aerospace Engineering, New Mexico State University
- Assistant Professor (2001 – 2007, 2007—2010 (with tenure)), Department of Mechanical and Aerospace Engineering, New Mexico State University

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Postdoctoral Scholar (1998--2000), Control and Dynamical Systems, California Institute of Technology, Pasadena, California.
- Research Scientist (1991--1993), Experimental Aerodynamics Division, National Aerospace Laboratories, Bangalore—India.

Certifications or professional registrations

- None

Current membership in profession organizations

- None

Honors and awards

- Alexander von Humboldt Fellowship, Alexander von Humboldt Foundation, Germany (2008, 2009, 2010 and 2015)

Service activities (within and outside of the institution)

- Reviewer – Journal of Nonlinear Science, SIAM Journal of Applied Mathematics, Physics of Fluids, Journal of Fluid Mechanics

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- A. Hernández-Garduño and B. N Shashikanth (2018), Reconstruction phases in the planar three- and four-vortex problems, Nonlinearity, Vol. 31, pp. 783--814.
- B. N. Shashikanth (2017), On the Hamiltonian equations for the coupled system of a free surface and a rigid body, The IV AMMCS International Conference, Waterloo, Ontario, Canada, August 20-25.
- B. N. Shashikanth (2016), Kirchhoff's equations of motion via a constrained Zakharov system, Journal of Geometric Mechanics, Vol. 8(4), pp. 461--485.
- B. N. Shashikanth (2014), On compressible adiabatic inviscid flow equations in divergence form and their Lie-Poisson brackets, 17th U.S. National Congress on

Theoretical and Applied Mechanics, Michigan State University, USA, 15-20 June.

- D. Hartmann, W. Schröder and B. N. Shashikanth (2012), Non-invasive determination of external forces in vortex-pair-cylinder interactions, Physics of Fluids, Vol. 24, 061903, (27 pages).
- B. N. Shashikanth (2012), Vortex dynamics in R^4, Journal of Mathematical Physics, Vol. 53, issue 1, 013103 (21 pages).

Briefly list the most recent professional development activities

Sabbatical Leave & Research Visits:

- Department of Mathematics, University of Toronto, Toronto, Canada. March 2015 (2 weeks)
- Department of Mechanical Engineering and Engineering Science, University of North Carolina, Charlotte, USA. Feb 2015 (2 weeks)
- Aerodynamics Institute, RWTH-Aachen University, Aachen, Germany. May 2015
- Department of Mathematical Sciences, New Jersey Institute of Technology, Newark, New Jersey, USA. Feb 2015 (2 weeks)

Fangjun Shu

Education – degree, discipline, institution, year

- Ph.D. in Mechanical Engineering, Purdue University – West Lafayette (2005)
- MS in Mechanical Engineering, University of Science and Technology of China – P. R. China (2000)
- BS in Mechanics and Mechanical Engineering, University of Science and Technology of China – P. R. China (1997)

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- Associate Professor (08/16 – present), Assistant Professor (08/2010 – 08/2016), Department of Mechanical and Aerospace Engineering, New Mexico State University, Las Cruces, New Mexico
- Research Scientist (03/2009 – 07/2010), Department of Mechanical and Aerospace Engineering, the George Washington University, Washington, District of Columbia
- Postdoctoral Research Associate (01/2007 – 02/2009), Department of BioEngineering and Surgery, University of Pittsburgh, Pittsburgh, Pennsylvania
- Post Postdoctoral Research Associate (01/2006 – 12/2006), Department of BioMedical Engineering, Carnegie Mellon University, Pittsburgh, Pennsylvania

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- None

Certifications or professional registrations

- None

Current membership in profession organizations

- American Physical Society (APS), The American Institute of Aeronautics and Astronautics (AIAA)

Honors and awards

- Outstanding Teaching Professor, MAE academy of New Mexico State University, 2018
- Donald C. Roush Excellence in Teaching Award, New Mexico State University, December, 2016
- Reported by Engineering TV, May 1, 2007
- Group work was reported in Voice of America (VOA), October 3, 2006
- Reported in MEMO, the School of Mechanical Engineering magazine at Purdue University, 2005
- Frederick A. Environmental Award, Purdue University, August 2004
- Guang-Hua Educational Scholarship, USTC, 1998-1999
- Excellent Student Scholarship of USTC, 1995-1996 and 1994-1995

Service activities (within and outside of the institution)

- Proposal reviewer, National Science Foundation
- College of Engineering Graduate Committee, member
- MAE department ABET Committee, member
- Reviewer – Physics of Fluids, Mechanical Systems and Signal Processing, Journal of Renewable and Sustainable Energy, ASME Journal, AIAA conference, Journal of Engineering in Medicine, Artificial Organs, International Journal of Aerospace and Lightweight Structures, Experiments in Fluids, European Journal of Mechanics - B/Fluids, The Annals of Thoracic Surgery, Hemodialysis International, IEEE Control Systems Society Conference, Energies, and International Journal of Micro Air Vehicles

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- J. Ahumada, M. De la Torre, Fangjun Shu, R.H. Chen (2018), Experimental Study of an Underexpanded Supersonic Jet under Non-Swirling and Swirling Conditions, AIAA Science and Technology Forum, Kissimmee FL.
- M. Talavera, and Fangjun Shu (2017) Experimental Study of Turbulence Intensity Influence on Wind Turbine Performance and Wake Recovery, Renewable Energy, Vol. 109, 363-371.
- S. D. Rodriguez, H.N. Chung, K. K. Gonzales,J. Vulcan, Y. Li, J. A. Ahumada, H.M. Romero, M. De La Torre, Fangjun Shu, and I. A. Hansen, (2017) Efficacy of Some Wearable Devices Compared with Spray-On Insect Repellents for the Yellow Fever Mosquito, Aedes aegypti (L.) (Diptera: Culicidae), Journal of Insect Science, 17(1): 24; 1-6.
- Fangjun Shu, R. Tian, S. Vandenberghe, and J. Antaki (2016) Experimental study of microscale Taylor vortices within a co-axial mixed-flow blood pump, Artificial Organs, 40(11):1071-1078.
- R. Tian, E. Marquez, H. Bocanegra, B.J. Balakumar, and Fangjun Shu (2015) Experimental study of Reynolds number and gust influence on transient force and flow generated by a robotic Hummingbird, International Journal of Micro Air Vehicles, 7 (3), 347-360.
- Fangjun Shu, S. Vandenberghe, J. Brackett , and J. Antaki (2015) Classification of Unsteady Flow Patterns in a Rotodynamic Blood Pump: Introduction of Non-Dimensional Regime Map, Cardiovascular Engineering and Technology, 6(3), 230-241.
- S.E. Jahren, G. Ochsner, Fangjun Shu, R. Amacher, J. Antaki, and S. Vandenberghe (2014) Analysis of Head-pump Flow Loops of Pulsatile Rotodynamic Blood Pumps, Artificial Organs, 38(4) 316-326.
- R. Tian, R. Mitchell, L. Martin-Alarcon, and Fangjun Shu (2013) Experimental Investigation of 2D Flexible Plunging Hydrofoil, Journal of Flow Visualization and Image Processing, 20(4), 243-260.
- A.L. Glenn, K.V. Bulusu, Fangjun Shu and M.W. Plesniak (2012) Secondary Flow Structures Under Stent-Induced Perturbations for Cardiovascular Flow in a Curved Artery Model, International Journal of Heat and Fluid Flow, Vol. 35, 76-83.

Briefly list the most recent professional development activities

- Attended APS division of fluid dynamics annual conferences and AIAA Scitech conferences 2018.

Liang Sun

Education – degree, discipline, institution, year

- Ph.D. in Electrical and Computer Engineering, Brigham Young University (2012)
- MS in Electrical Engineering and Automation, Beihang University - China (2017)
- BS in Electrical Engineering and Automation - China (2004)

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- Assistant Professor (08/2015 - present), Department of Mechanical and Aerospace Engineering, New Mexico State University, Las Cruces, New Mexico
- Post-doctoral Research Fellow (08/2014 - 08/2015), Department of Electrical and Computer Engineering, The University of Texas at San Antonio, San Antonio, Texas
- Post-doctoral Research Fellow (04/2013 - 08/2014), Department of Electrical and Computer Engineering, United States Air Force Academy, Colorado
- Research Assistant (09/2007 - 04/2013), Department of Electrical and Computer Engineering, Brigham Young University, Provo, Utah

Certifications or professional registrations

- None

Current membership in profession organizations

- American Institute of Aeronautics and Astronautics (AIAA)
- Institute of Electrical and Electronics Engineers (IEEE)
- IEEE Robotics and Automation Society, IEEE Control Systems Society
- IEEE Aerospace and Electronic Systems Society

Honors and awards

- Outstanding Graduate Award, (10/180), Beihang University, 2005
- Beijing Outstanding Undergraduate Award, (10/360), Beihang Univeristy, 2004
- Top Ten Outstanding League Cadre Award, (10/360), Beihang University, 2004
- Excellent Student Cadre Award, (10/360), Beihang University, 2003
- Merit Student Awards, (10/360), Beihang University, 2000-2002
- Third-class People's Scholarship Award, (20/360), Beihang University, 2000
- Second-Class People's Scholarship Award, (10/360), Beihang University, 2000

Service activities (within and outside of the institution)

- Proposal reviewer/panelist, National Science Foundation, 2017 (twice)
- Faculty Search Committee, New Mexico State University, 2017 (twice)
- Associate Editor, International Journal of Advanced Robotic Systems (2015-present)
- Conference Session Chair, IEEE ICUAS (2016, 2017), ASME DSCC (2016)

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Selije II, R. and Sun, L., "A Survey of Hardware Advances and Techniques for Vision-Based Object Detection, Classification, and Tracking", International Conference of Control, Dynamic Systems, and Robotics, Niagara Falls, Canada, June 2018, accepted.
- Gala, D., Lindsay, N., and Sun, L., "Three-Dimensional Sound Source Localization for Unmanned Ground Vehicles with a Self-Rotational Two-Microphone Array", International Conference of Control, Dynamic Systems, and Robotics, Niagara Falls, Canada, June 2018, accepted.
- Dutta, R., Sun, L., and Pack, D., "A Novel Decentralized Formation Controller for Multiple Unmanned Systems with Maintaining and Tracking Network Connectivity", IEEE Transactions on Control Systems Technology, accepted, in press, 2017.
- Farmani, N., Sun, L., and Pack, D., "A Scalable Multi-Target Tracking System For Cooperative Unmanned Aerial Vehicles", IEEE Transactions on Aerospace and Electronic Systems, vol. 53(4), 2017, pp. 1947-1961.
- Zhong, X., Sun, L., and Yost, W, "Active Binaural Localization of Multiple Sound Sources", Robotics and Autonomous Systems, Vol. 85, 2016, pp. 83-92.
- Zhao, H., Jin, T., Wang, S., and Sun, L., "A Real-Time Selective Harmonic Elimination Based on A Transient-free, Inner Closed-Loop Control for Cascaded Multilevel Inverter", IEEE Transactions on Power Electronics, Vol. 31(2), 2016, pp. 1000-1014.
- Sun, L., Castagno, J., Hedengren, J. D., and Beard, R. W., "Parameter Estimation for Towed Cable Systems Using Moving Horizon Estimation", IEEE Transactions on Aerospace and Electronic Systems, Vol. 51(2), 2015, pp. 1432-1446.
- Lwowski, J., Sun, L., Mexquitic-Saavedra, R., Sharma, S., and Pack, D., "A Reactive Bearing An- gle Only Obstacle Avoidance Technique for Unmanned Ground Vehicles", Journal of Automation and Control Research, Vol. 1(1), 2014, pp. 22-28.
- Nichols, J. W., Sun, L., Beard, R. W., and McLain, T. W., "Aerial Rendezvous of Small Unmanned Aircraft Using a Passive Towed Cable System", AIAA Journal of Guidance, Control, and Dynamics, Vol. 37(4), 2014, pp. 1131-1142.
- Sun, L., Hedengren, J. D., and Beard, R. W., "Optimal Trajectory Generation Using Model Predictive Control for Aerially Towed Cable Systems", AIAA Journal of Guidance, Control, and Dynamics, Vol. 37(2), 2014, pp. 525-539.
- Al-Radaideh, A. and Sun, L., "Self-Localization of a Tethered Quadcopter Using Onboard Sensors in a GPS-Denied Environment", IEEE International Conference on Unmanned Aircraft Systems, Miami, FL, USA, June 2017, pp. 271-277.

Briefly list the most recent professional development activities

- n.a.

Engineering Physics Program

(Bachelor of Science in Engineering Physics)

at

New Mexico State University

Tenured & Tenure-Track Faculty – Department of Electrical & Computer Engineering

Abdel-Hameed Badawy

Education - degree, discipline, institution, year

- PhD Computer Engineering University of Maryland, College Park, MD, USA
- 2013
- MSc Computer Engineering University of Maryland, College Park, MD, USA
- 2002
- BSc Electronics Engineering Mansoura University 1996 3. Academic Experience:

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State University, Assistant Professor.,June 2016 – Present, FT
- Arkansas Tech University, Assistant Professor, August 2013 – May 2016, FT

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- The George Washington University, Lead Research Scientist, May 2014 – Jan 2016, PT

Certification or professional registration

- MSU Online Course Improvement Program (OCIP) New2Online (N2O), December 2016
- eTech Online Certification Program, December 2013

Membership in professional organizations

- Senior Member, Institute of Electrical and Electronics Engineers (IEEE)
- Association of Computing Machinery (ACM)

Honors and awards

- Listed in Who's Who since 2014
- Award of Excellence for presentation at GRID 2004, UMD

Service activities (within and outside of the institution)

- Faculty Search committee member
- Member of technical program committee member for many conferences

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Nafiul A. Siddique, Patricia Gruble, Abdel-Hameed A. Badawy, and Jeanine Cook, "A Performance Study of the Time-Varying Cache Behavior – A Study on APEX, Mantevo, NAS, and PARSEC", Appears in The Journal of Supercomputing, Springer, September 2017
- Abdel-Hameed A. Badawy, and Donald Yeung, "Guiding Locality Optimizations for Graph Computations via Reuse Distance Analysis", Appears in IEEE Computer Architecture Letters, April 2017

- Vikram Narayana, Shuai Sun, Abdel-Hameed A. Badawy, Volker Sorger, and Tarek El-Ghazawi, "MorphoNoC: Exploring the Design Space of a Configurable Hybrid NoC using Nanophotonics", Appears, Microprocessors and Microsystems (MICPRO), Elsevier, March 2017
- Joe Touch, and Abdel-Hameed A. Badawy, "Optical Computing", Appears as an editorial in a Special Issue on Optical Computing in the Nanophotonics, published by DE GRUYTER, 2017
- Abdel-Hameed A. Badawy, Gabriel Yessin, Vikram Narayana, Tarek ElGhazawi, and David Mayhew, "Optimizing Thin Client Caches for Mobile Cloud Computing", Appears in Concurrency and Computation: Practice & Experience, October 2016
- Ahmad Anbar, Olivier Serres, Engin Kayraklioglu, Abdel-Hameed Badawy, and Tarek El-Ghazawi, "Exploiting Hierarchical Locality in Deep Parallel Architectures", Appears in ACM Transactions on Architecture and Code Optimization (TACO), June 2016
- Shuai Sun, Abdel-Hameed A. Badawy, Vikram Narayana, Tarek El-Ghazawi, and Volker Sorger, "HyPPI: Hybrid Photonic Plasmonic Interconnects: A Low Latency, Area and Energy Efficient Onchip Interconnects", Appears in the IEEE Photonics Journal, Volume 7, Issue 6, December 2015

Briefly list the most recent professional development activities

- Several training workshops at the Teaching Academy at New Mexico State University
- Attended the NMTIE conference for Educational Technology.

Deva K. Borah

Education - degree, discipline, institution, year

- BE Electronics & Communications Eng. Indian Institute of Science, Bangalore, India 1987
- ME Electrical Communications Eng. Indian Institute of Science, Bangalore, India 1992
- PhD Telecommunications Eng. Australian National University, Canberra 2000

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State University, Professor, 2012 – Present, FT
- New Mexico State University, Associate Professor, 2006 – 2012, FT
- New Mexico State University, Assistant Professor, 2000 – 2006, FT

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Oxford University Press, Accuracy checker for a textbook and problem solutions, 2015 – 2016, PT
- McGraw-Hill Higher Education , Accuracy checker for a textbook and problem solutions, 2010 – 2012, PT

Membership in professional organizations

- Senior Member, Institute of Electrical and Electronics Engineers (IEEE)

Honors and awards

- Best Paper Award, IEEE Global Communications Conference (Globecom), Washington DC, Dec. 2016.
- Author of a featured article, Electronics Letters, October 2011.
- Advisor (Co-author) of multiple best student paper awards at the annual International Telemetry Conference held during 2012-2016.

Service activities (within and outside of the institution)

- Graduate Program Coordinator, ECE Department, NMSU, 2017 - Present
- Technical Program Committee Member of many international conferences, such as IEEE MILCOM 2017, IEEE ICC 2017, IEEE ICCVE 2016, IEEE Globecom 2016, IEEE MILCOM 2016 etc.
- Member, Admission Appeals Committee, NMSU, Jan. 2012 – Jan. 2017.
- Member, ECE Departmental Promotion and Tenure Committee, 2017–Present.

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- J. Perez-Ramirez and D. K. Borah, "Compressive Parameter Estimation for Correlated Frames in MIMO Visible Light Communications" IEEE Signal Processing Letters, Vol. 23, pp. 174-178, Jan. 2016.

- Y. Sun, D. K. Borah and E. Curry " Optimal Symbol Set Selection in GSSK Visible Light Wireless Communication Systems " IEEE Photonics Technology Letters, Vol. 28, pp. 303-306, Feb. 1, 2016.
- K. Kumar and D. K. Borah, "Quantize and Encode Relaying through FSO and Hybrid FSO/RF Links" IEEE Transactions on Vehicular Technology, vol. 64, pp. 2361-2374, June 2015.
- J. Perez-Ramirez, D. K. Borah, and D. G. Voelz, "Optimal 3D Landmark Placements for Vehicle Localization using Heterogeneous Sensors," IEEE Transactions on Vehicular Technology, vol. 62, pp. 2987-2999, Sept. 2013.

Briefly list the most recent professional development activities

- Attending NMSU Teaching Academy seminars, e.g., effective learning strategies 2016, and flipping classroom – just-in-time teaching workshop 2014

Laura E. Boucheron

Education - degree, discipline, institution, year

- B.S. Electrical Engineering, New Mexico State University, 2001
- M.S. Electrical Engineering, New Mexico State University, 2003
- Ph.D. Electrical & Computer Engineering, University of California Santa Barbara, 2008

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State University, Associate Professor, 2017—present, FT
- New Mexico State University Assistant Professor, 2011—2017, FT
- New Mexico State University. Research Assistant Professor, 2010-2011, FT
- New Mexico State University, Postdoctoral Fellow, 2008-2009, FT

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Los Alamos National Laboratory, Graduate Research Assistant, 2005-2007, FT

Certification or professional registration

- None.

Membership in professional organizations

- Member, Institute of Electrical and Electronics Engineers (IEEE), Signal Processing Society, Engineering in Medicine and Biology Society
- Member, American Society of Engineering Educators (ASEE)
- Member, Eta Kappa Nu (HKN)

Honors and awards:

- Donald C. Roush Excellence in Teaching Award, NMSU, 2014

Service activities (within and outside of the institution):

- Chair elect, University Research Council (URC), 2017—present
- Member, ECE Undergraduate Studies Committee, 2017—present
- Faculty Advisor, Women in STEM (WiSTEM), 2015—present

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- L. E. Boucheron, M. Valluri, and R. T. J. McAteer, “Segmentation of Coronal Holes Using Active Contours Without Edges,” Solar Physics, vol. 291, pp. 2353-2372, 2016.
- Al-Ghraibah, L. E. Boucheron, and R. T. J. McAteer, “An automated classification approach to ranking photospheric proxies of magnetic energy build-up,” Astronomy & Astrophysics, vol. 579, p. A64, 2015.
- S. M. Bannister, L. E. Boucheron, and D. G. Voelz, “A numerical analysis of a frame calibration method for video-based all-sky camera systems,” Publications of the Astronomical Society of the Pacific, vol. 125, no. 931, pp. 1108-1118, 2013.

- J. M. Stiles, R. Pham, R, K. Rowntree, C. Amaya J. Battiste, L. E. Boucheron, D. C. Mitchell, and B. A. Bryan, “Morphological restriction of human coronary artery endothelial cells substantially impacts global gene expression patterns,” FEBS Journal, vol. 280, no. 18, pp. 4474-4494, 2013.

Briefly list the most recent professional development activities

- SF EEC Grantees Conference, 2017 b. NMSU Teaching Academy, How Learning Works Book Club, 2015

Sukumar Brahma

Education – degree, discipline, institution, year

- 1989, B.Eng., Gujarat University, Ahmedabad, India. 1997
- M.Tech., Indian Institute of Technology, Bombay, India
- 2003 Ph.D.: Clemson University, Clemson, USA.

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- August 2012 – Present, Associate Professor, Klipsch School of Electrical and Computer Engineering, New Mexico State University •
- July 2007 – July 2012, Assistant Professor, Klipsch School of Electrical and Computer Engineering, New Mexico State University
- September 2003-June 2007, Assistant Professor, Department of Electrical Engineering, Widener University
- December 1990- August 1999, Lecturer, Department of Electrical Engineering, B. V. M. Engineering College, India

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- September 1990 - December 1990, Assistant Engineer, Ahmedabad Electricity Company, India
- August 1989 – August 1990, Graduate Trainee, Ahmedabad Electricity Company, India

Membership in professional organizations:

- Senior Member, IEEE
- Member IEEE Power and Energy Society (PES)

Honors and awards

- Received Donald C. Roush Award for Excellence in Teaching from New Mexico State University in Spring 2016.
- William Kersting Endowed Chair, starting January 2014.
- Member of three working groups of IEEE Power System Relaying and Control Committee (PSRCC) that won best WG awards.
- IEEE PSRC Working Group K15 (member), "Advancements in Centralized Protection and Control within a Substation," IEEE Transactions on Power
- Delivery – Special Issue on Frontiers of Power System Protection, Vol. 31, No. 4, pp. 1945 – 1952, August 2016. - Best paper award, 2016.

Service activities (within and outside of the institution)

- Chair Power and Energy Education Committee (PEEC); Past Chair Lifelong Learning Subcommittee
- Member Power System Relaying Committee
- Member Power System Analysis, Computing and Economics Committee; Past Chair Distribution System Analysis Subcommittee.

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation:

- Yinan Cui, Rajesh Kavasseri, and Sukumar Brahma, "Dynamic State Estimation Assisted Out-of-Step Detection for Generators Using Angular Difference", IEEE Trans. Power Delivery, Vol. 32, No. 3, pp. 1441 - 1449, June 2017.
- S. Brahma, R. Kavasseri, Huiping Cao, N. R. Chaudhuri, T. Alexopoulos, and Y. Cui, "Real Time Identification of Dynamic Events in Power Systems using PMU data, and Potential Applications – Models, Promises, and Challenges", IEEE Trans. Power Delivery – Special Issue on Innovative Research Concepts for Power Delivery Engineering, Vol. 32-1, pp. 294 - 301, Feb. 2017.
- P. H. Gadde, Milan Biswal, Sukumar Brahma, and Huiping Cao, "Efficient Compression of PMU Data in WAMS", IEEE Trans. Smart Grid – Special Issue on Big Data Analytics for Grid Modernization, Vol. 7, No. 5, pp.2406 – 2413, September 2016.
- Milan Biswal, Sukumar Brahma, and Huiping Cao, "Supervisory Protection and Automated Event Diagnosis using PMU Data, IEEE Trans. Power Delivery – Special Issue on Frontiers of Power System Protection, Vol. 31, No. 4, pp. 1855 – 1863, August 2016.
- Om Prasad Dahal, S. M. Brahma, and Huiping Cao, "Comprehensive Clustering of Disturbance Events Recorded by Phasor Measurement Units", IEEE Trans. Power Delivery, Vol. 29-3, pp. 1390-1397, June 2014.

Briefly list the most recent professional development activities

- Member of 16 working groups of IEEE Power System Relaying and Control Committee (PSRCC). I chair one WG.
- Editor, IEEE Transactions on Power Delivery, Guest Editor in Chief, Special Issue of Frontiers in power System Protection, IEEE Transactions on Power Delivery, Volume 31-4, Aug. 2016.
- Served on Guest Editorial Board of Special Issue on Innovative Research Concepts for Power Delivery Engineering from IEEE Transactions on Power Delivery – 2016-17.

Sang-Yeon Cho

Education - degree, discipline, institution, year

- Doctor of Philosophy, Electrical and Computer Engineering, Georgia Institute of Technology, 2003
- Master of Science, Electrical and Computer Engineering, Georgia Institute of Technology, 2000
- Bachelor of Science, Electrical and Computer Engineering, Sungkyunkwan University. 1996

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State University, Associate Professor, 2013-present, FT
- New Mexico State University, Assistant Professor, 2007-2013, FT
- Duke University, Assistant Research Professor, 2004-2007, FT

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Air Force Research Laboratory, Visiting Faculty Researcher, Design photonic devices, 2008, FT
- Oak Ridge National Laboratory, Visiting Faculty Researcher, Design cavity-based quantum devices, 2016, FT

Certification or professional registration

- None

Membership in professional organizations

- Senior Member, Optical Society of America
- Member, The Institute of Electrical and Electronics Engineers

Honors and awards

- Foreman Faculty Excellence Award, College of Engineering, NMSU, 2015
- Research Achievement Award, NMSU, 2012
- Recipient of the Grand Challenges Explorations, Bill and Melinda Gates Foundation, 2010

Service activities (within and outside of the institution)

- Journal Reviewer (Journals published by American Institute of Physics (AIP), Optical Society of America (OSA), and IEEE).
- National Science Foundation (NSF) Panelist, 2010 (ECCS), 2012(CMMI), 2013 (ECCS).
- National Aeronautics and Space Administration (NASA) Reviewer, 2015, 2016

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Charles Pelzman and Sang-Yeon Cho, "Control of Plasmon Resonance by Mode Coupling in Metal-Dielectric Nanostructures," AIP Journal of Applied Physics 121, 133102, 2017.
- Charles Pelzman, Sang-Yeon Cho, "Deformable Plasmonic Metamembrane," The 2017 IEEE Photonics Conference, 30th Annual Conference of the IEEE Photonics Society, WP-23, 1-5 October, 2017.
- Charles Pelzman, Sang-Yeon Cho, "Active Plasmonic Nanospirals," The 2017 IEEE Photonics Conference, 30th Annual Conference of the IEEE Photonics Society, WP- 22, 1-5 October, 2017.
- Jordan Hachtel, Roderick Davidson, Matthew Chisholm, Richard F Haglund, Sokrates Pantelides, Sang-Yeon Cho, Benjamin Lawrie, "Nano-chirality detection with vortex plasmon modes," Conference on Lasers and Electro-Optics (CLEO), FM3H.5, 2017.
- Charles Pelzman and Sang-Yeon Cho, "Plasmonic Metasurface for Simultaneous Detection of Polarization and Spectrum," OSA Optics Letters 41, 1213-1216, 2016.
- Charles Pelzman and Sang-Yeon Cho, "Polarization-Selective Optical Transmission Through a Plasmonic Metasurface," AIP Applied Physics Letters 106, 251101, 2015.

Briefly list the most recent professional development activities

- Talks attended at IEEE and OSA Conferences
- Seminars attended at New Mexico State University

Charles D. Creusere

Education - degree, discipline, institution, year

- B.S. Electrical & Computer Engineering, University of California, Davis, 1985
- M.S. Electrical & Computer Engineering, University of California, Santa Barbara, 1990
- Ph.D. Electrical & Computer Engineering, University of California, Santa Barbara, 1993

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- NMSU, Assistant Professor, 2000-2004, FT
- NMSU, Associate Professor, 2004-2010, FT
- NMSU, Professor & Frank Carden Chair, 2010-present, FT

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- NAVAIR MTS, Engineering Design/Analysis, 10/198512/1999, FT
- Bell Labs, Summer Intern, Research, Summer 1992, PT

Certification or professional registration

- None

Membership in professional organizations

- Institute of Electrical & Electronic Engineers (IEEE)
- Signal Processing Society of IEEE
- Geoscience and Remote Sensing Society of IEEE

Honors and awards

- Current holder of Frank Carden Chair in Telemetry and Telecommunications
- 1st awardee of the International Foundation for Telemetering Professorship

Service activities (within and outside of the institution)

- Senior Area Editor IEEE Transactions on Image Processing
- Technical Program Chair, IEEE SSIAI 2012/2014, International Telemetering Conference 2015
- Past Associate Editor, 2 3-year terms IEEE Trans. on Image Processing, IEEE Transactions on Multimedia
- Chair, ECE P&T Committee
- Member, College of Engineering Awards Committee

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation:

- V. Thilak, C.D. Creusere, and D. Voelz, "Passive Polarimetric Imagery-Based Material Classification Robust to Illumination Source Position and Viewpoint," Image Processing, IEEE Transactions on , vol.20, no.1, pp.288-292, Jan. 2011.

- C.D. Creusere and J. Hardin, "Assessing the Quality of Audio Containing Temporally Varying Distortions," Audio, Speech, and Language Processing, IEEE Transactions on , vol.19, no.4, pp.711-720, May 2011.
- Castorena, J.; Creusere, C.D., "The Restricted Isometry Property for Banded Random Matrices," Signal Processing, IEEE Transactions on , vol.62, no.19, pp.50735084, Oct.1, 2014.
- Castorena, J.; Creusere, C.D., "Sampling of Time-Resolved Full-Waveform LIDAR Signals at Sub-Nyquist Rates," Geoscience and Remote Sensing, IEEE Transactions on , vol.53, no.7, pp.3791-3802, July 2015.

Briefly list the most recent professional development activities

- Title IX Training, 10/17/2017

Muhammad Dawood

Education - degree, discipline, institution, year

- Ph.D Electrical Engineering, University of Nebraska, Lincoln, 2002
- M.S. Electrical Engineering, University of Nebraska, Lincoln, 1998
- B.E. Electrical Engineering (Avionics), NED University of Engineering and Technology, Pakistan, 1985

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State University, Associate Professor, 2011-present, FT
- New Mexico State University, Assistant Professor, 2005-2010, FT
- University of Kansas, Research Assistant Professor, 2002-2005, FT
- University of Nebraska, Instructor, 2002, FT

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Tellabs Inc., Research Engineer, RF/Wireless/ UWB Systems, April 2001 - Dec 2001, FT
- PIA, Researcher, RF Boards and Systems, 1995-1996, FT

Certification or professional registration

- None

Membership in professional organizations

- Member, IEEE

Honors and awards

- Most Distinguished Member for 2006-2007, Teaching Academy, NMSU
- First Prize: Graduate Student Paper Competition, University of Nebraska, Lincoln, 1999.

Service activities (within and outside of the institution)

- Member UGS at NMSU
- Reviewer IEEE AES, APS, Radar, and IET
- Advisor, IEEE Student Chapter, NMSU, 2007– 2012

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- M. Dawood, "Student Study Habits, Learning and Grades," Frontiers of Engineering Education, National Academy of Engineering, 8th Annual FOEE Symposium, 09/25-28/2016.
- M. Dawood, J. Tapia, M. Guynn, K. Trujillo, and P. Wojahn,"Preliminary results on students' study habits and their grades in STEM courses", 2017 IEEE International

Symposium on Antennas and Propagation – URSI Radio Science Meeting, San Diego, July 9 to July 14, 2017.

- M. Dawood, E. Sharif, and J. A. Boehm III, "Experimental Results for Sidelobe Reductions in Random Noise and Deterministic Signals," Electronics Letters (IET), Volume 53, Issue 8, April 2017, p. 564 - 566.
- V. Alejos, M. Dawood, and H. R. Mohammed, "Estimation of Sidelobe Level Variations of Phased Codes in Presence of Random Interference for Bistatic Wideband Noise Radar," International Journal of Antennas and Propagation, Article ID 297823, 2015, 11 pages.
- Dawood, M, Quraishi, N., Alejos, A., V., "Superresolution Doppler Estimation using UWB Random Noise Signals and MUSIC," IEEE Trans. Aerospace and Electronic Systems, Vol. 49, no. 1, pp. 325-340, January 2013.

Briefly list the most recent professional development activities

- Workshops on Metacognition and Student Learning, 2013-2017, NMSU
- Presentations on various antenna related technologies, IEEE APS/URSI, San Diego, July 9-14, 2017.

Phillip L. De Leon

Education - degree, discipline, institution, year

- B.S. Electrical Engineering, Univ of Texas at Austin, 1989
- B.A. Mathematics, Univ of Texas at Austin, 1990
- M.S. Electrical Engineering, Univ of Colorado at Boulder, 1992
- Ph.D. Electrical Engineering, Univ of Colorado at Boulder, 1995

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- NMSU, Professor & Associate Dean of Research, 2016-present, FT
- NMSU, Professor & Klipsch Distinguished Prof, 2006-present, FT
- NMSU, Associate Prof, 2002-2005, FT
- NMSU, Assistant Prof, 1996-2001, FT

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Sandia National Laboratories, Faculty Summer Fellow, Research in signal processing, Jun-Aug 2016 and May-Aug 2017, PT
- ParisTech Telecom & EURECOM, Visiting Faculty, Sabbatical research, Feb-May 2017, FT
- Vienna Univ of Technology, Visiting Faculty, Sabbatical research, Aug-Dec 2008, FT

Certification or professional registration

- N/A

Membership in professional organizations

- Senior Member, IEEE

Honors and awards

- Paul W. and Valerie Klipsch Endowed Professorship, 2015
- John and Tome Nakayama Professorship for Excellence in Teaching, 2012

Service activities (within and outside of the institution)

- ECE curriculum revision committee (chair), 2014-2015
- University Research Council (Engineering, Chair Elect, Chair), 2009-2012

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- S. Sandoval and P. L. De Leon, “Advances in Empirical Mode Decomposition for Computing Instantaneous Amplitudes and Instantaneous Frequencies,” Proc. IEEE Int. Conf. on Acoustics, Speech & Signal Processing (ICASSP), 2017.
- M. Martinez, P. L. De Leon, and D. Keeley, “Novelty Detection for Predicting Falls Risk using Smartphone Gait Data,” Proc. IEEE Int. Conf. on Acoustics, Speech & Signal Processing (ICASSP), 2017.

- Z. Wu, P. L. De Leon, C. Demiroglu, A. Khodabakhsh, S. King, Z. Ling, D. Saito, B. Stewart, T. Toda, M. Wester, and J. Yamagishi, "Anti-Spoofing for Text-Independent Speaker Verification: An Initial Database, Comparison of Countermeasures, and Human Performance," IEEE Trans. Audio, Speech, and Language Proc., vol. 24, no. 4, pp. 768-783, Apr. 2016.
- S. Sandoval, P. L. De Leon, and J. M. Liss, "Hilbert Spectral Analysis of Vowels using Intrinsic Mode Functions," in Proc. IEEE Automatic Speech Recognition & Understanding Workshop (ASRU), 2015.
- R. McClanahan and P. L. De Leon, "Reducing Computation in an i-Vector Speaker Recognition System using a Tree-Structured Universal Background Model," Speech Communication, vol. 66, pp. 36-46, Feb. 2015.

Briefly list the most recent professional development activities

- iOS Programming with Swift, Big Nerd Ranch, June 2015

Paul M. Furth

Education - degree, discipline, institution, year

- B.A. French, Grinnell College, 1984
- B.S. Engineering (Electrical), California Inst. of Tech., 1985
- M.S. Electrical Engineering, Johns Hopkins University, 1992
- Ph.D. Electrical Engineering, Johns Hopkins University, 1996

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State Univ. (NMSU), Associate Professor, 2001-present, FT
- NMSU, Associate Department Head, 2002-2006, 2015-present, PT
- NMSU, Interim Department Head, 2009-2010, FT
- NMSU, Assistant Prof., 1995-2001, FT

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Sandia National Laboratories, University Summer Faculty, Summer 2008, FT
- Micron Semi., Visiting Faculty, Summer 2007, FT
- Motorola & JTA, Consulting IC Designer, Design mixed-signal ICs, Summers 2000 and 2003, FT
- TRW Technar, Project Engineering, Design test equipment, 1985-1989,FT

Certification or professional registration

- None

Membership in professional organizations

- Senior Member, IEEE (Institute of Electrical and Electronic Engineers)
- Member, NMSU (New Mexico State University) Teaching Academy

Honors and awards

- John Kaichiro and Tome Miyaguchi Nakayama Professorship for Teaching Excellence, 2015
- Donald C. Roush Excellence in Teaching Award, NMSU, 2012
- Bromilow Teaching Award for Teaching Excellence, 2008

Service activities (within and outside of the institution)

- Steering Committee Member, IEEE Midwest Symposium on Circuits and Systems Conference MWSCAS 1996-2000, 2011-present
- Chair, ECE Undergraduate Studies Committee, 2010-2011, 2015-present

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Y. Liu, P.M. Furth and W. Tang, “Hardware-Efficient Delta Sigma-Based Digital Signal Processing Circuits for the Internet-of-Things,” Journal of Low Power Electronics and Applications, 5(4), 234-256, Nov. 2015.
- P.R. Surkanti, V. Siripurapu, and P.M. Furth, “A high precision and high speed voltage-mode loser/winner-take-all circuit,” 58th IEEE Midwest Symposium on Circuits and Systems, Fort Collins, CO, August 2015.
- H. Valapala and P. M. Furth,”Fully Integrated 1.2-µA and 13-µA Quiescent Current LDOs with Improved Transient Response,” Analog Integrated Circuits and Signal Processing, vol. 78, no. 2, pp. 287-297, Feb. 2014.

Briefly list the most recent professional development activities

- NMSU Teaching Academy, Workshop Series, “Evidence-Based Instructional Practices,” Spring, 2017.
- NMSU Teaching Academy, Workshop, “Getting Our Students to Work in Every Class,” Ed Prather, Jan. 30, 2017.

Hong Huang

Education - degree, discipline, institution, year

- B.Engr. Engineering Physics, Tsinghua University, 1985
- M.S. Electrical & Computer Engineering, Georgia Institute of Technology, 2000
- Ph.D. Electrical & Computer Engineering, Georgia Institute of Technology, 2002

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State University, Associate Professor, 2009-present, FT
- New Mexico State University, Assistant Professor, 2003-2009, FT

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Junda Inc., Engineer, Engineering and Design, 1985-1996, FT

Certification or professional registration

- None

Membership in professional organizations

- Member, IEEE

Honors and awards

- Research Achievement Award, NMSU, 2016
- Best Paper Award, IEEE High Performance Switching and Routing Conference, 2002
- Amelio Prize ($1500), for excellent academic performance, Georgia Tech, 1999
- Excellent Graduates, for ranking 1st in Class (department) on graduation, Tsinghua Univ. 1985

Service activities (within and outside of the institution)

- Session chair in the IEEE VTC 2005
- TPC member in the IEEE ICC 2006 and IEE MILCOM 2016.
- Member of faculty senate, EE department head advisory committee, graduate studies committee, faculty search committees at NMSU.

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Y. Jaradat, H. Huang, M. Masoud, and I. Janoud, “Capacity of Wireless Networks with Directed Energy Links in the Presence of Obstacles,” IEEE Transactions on Wireless Communications (under revision).
- H. Huang, Y. Jaradat, R. A.-Cacheda, S. Misra, R. Tourani, M. Masoud and I. Jannoud, "Capacity of Large-Scale Wireless Networks Under Jamming: Modeling and Analyses," IEEE Transactions on Vehicular Technology, in press.

- S. Misra, R. Tourani, F. Natividad, T. Mick, N. Majd, and H. Huang, “FaSt: A Framework for Secure Content Delivery in Information-Centric Networks,” IEEE Transactions on Dependable and Secure Computing, in press.

Briefly list the most recent professional development activities

- IEEE Webinar on 5G Wireless Technology, Oct., 2017

David G. M. Mitchell

Education - degree, discipline, institution, year

- B.Sc. Mathematics, University of Edinburgh, UK, 2005
- Ph.D. Electrical Engineering, University of Edinburgh, UK, 2009

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State University, Assistant Professor, 2015-present, FT
- University of Notre Dame, Visiting Assistant Professor, 2012-2015, FT
- University of Notre Dame, Post-Doctoral Research Associate, 2009-2012, FT

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- none

Certification or professional registration

- none

Membership in professional organizations

- Senior Member, Institute of Electrical and Electronics Engineers (IEEE)
- Member, IEEE Information Theory Society

Honors and awards

- New Mexico State University, Distinguished Member of the Teaching Academy, 2015.
- Striving for Excellence in College and University Teaching Award, University of Notre Dame, July 2015
- Best Paper Award, International Symposium on Turbo Codes, 2012.

Service activities (within and outside of the institution)

- Member, Hiring Committee, Klipsch School of ECE, 2016-present
- Chair, Klipsch School of ECE, Ph.D. Qualifying Exam Committee, 2016-present
- Publicity Chair, 2018 IEEE Information Theory Workshop
- Organizer, Las Cruces "Touch-a-Truck" event (community outreach), 2015-present

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- M. Zhu, D. G. M. Mitchell, M. Lentmaier, D. J. Costello, Jr., and B. Bai, "Braided Convolutional Codes with Sliding Window Decoding," IEEE Transactions on Communications, vol. 65, no. 9, pp. 3645-3658, Sept. 2017
- L. Wei, D. G. M. Mitchell, T. E. Fuja, and D. J. Costello, Jr., "Design of Spatially Coupled LDPC Codes Over GF(q) for Windowed Decoding," IEEE Transactions on Information Theory, vol. 62, no. 9, pp. 4781-4800, Sept. 2016.

- D. G. M. Mitchell, M. Lentmaier, A. E. Pusane, and D. J. Costello, Jr., "Randomly Punctured LDPC Codes," IEEE Journal on Selected Areas in Communications, vol. 34, no. 2, pp. 408-421, Feb. 2016.
- D. G. M. Mitchell, M. Lentmaier, and D. J. Costello, Jr., "Spatially Coupled LDPC Codes Constructed from Protographs," IEEE Transactions on Information Theory, vol. 61, no. 9, pp. 4866-4889, Sep. 2015.
- K. Huang, D. G. M. Mitchell, L. Wei*, X. Ma, and D. J. Costello, Jr., "Performance Comparison of LDPC Block and Spatially Coupled Codes over GF(q)," IEEE Transactions on Communications, vol. 63, no. 3, pp. 592-604, Mar. 2015.

Briefly list the most recent professional development activities

- Self-regulated learning: active learning on the inside, NMSU Teaching Academy, Fall 2017.
- New2Online Teaching Scholarship, NMSU Teaching Academy, 2015-2016.

Kwong T. Ng

Education - degree, discipline, institution, year

- B.Eng. (Hons.) Electrical Engineering McGill University, Canada, 1979
- M.Sc. Electrical Engineering, The Ohio State University, 1981
- Ph.D. Electrical Engineering, The Ohio State University, 1985

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State University, Professor, 1995-present, FT
- New Mexico State University, Associate Professor, 1990-95, FT
- University of Virginia, Assistant Professor,1986-89, FT
- University of Virginia, Research Assistant Professor, 1985, FT

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- None

Certification or professional registration

- None

Membership in professional organizations

- Senior Member, Institute of Electrical and Electronics Engineers
- Member, Biomedical Engineering Society

Honors and awards

- Paul W. and Valerie Klipsch Distinguished Professor
- Who's Who Among America's Teachers
- Who's Who in Science and Engineering

Service activities (within and outside of the institution)

- NMSU College of Engineering Promotion and Tenure Committee
- NMSU College of Engineering Research and Development Team
- NMSU Library Liaison, Electrical and Computer Engineering
- NMSU ECE Promotion and Tenure Committee
- NMSU Professorship Review Committee
- NMSU Director, Electromagnetics and Microwave Laboratory

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- R. Khan and K. T. Ng, "Higher Order Finite Difference Modelling of Cardiac Propagation," Proceedings 2017 IEEE International Conference on Bioinformatics and Biomedicine, Kansas City, MO, November 13-16, 2017

- Sturdevant, R. Garcia, and K. T. Ng, "Efficient Implementation of EEG Beamformers for Source Detection on Mobile Platforms," Proceedings Biomedical Engineering Society Annual Meeting, Minneapolis, MN, October 58, 2016.
- H. V. Dang, K. T. Ng, and J. K. Kroger, "Novel Beamformers for Multiple Correlated Brain Source Localization and Reconstruction," Proceedings 36th International Conference on Acoustics, Speech and Signal Processing, Prague, Czech Republic, May 22-27, 2011.
- H. V. Dang and K. T. Ng, "Finite Difference Neuroelectric Modeling Software," Journal of Neuroscience Methods, vol. 198, pp. 359-363, 2011.

Briefly list the most recent professional development activities

- NMSU Teaching Academy
- Seminars at NMSU: 10

Krist Petersen

Education - degree, discipline, institution, year

- PhD Electrical Engineering, New Mexico State Univ., 1998
- MSEE Electrical Engineering, New Mexico State Univ., 1986
- BS Biology, Eastern New Mexico Univ., 1973

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State Univ., Assoc. Prof., Adjunct faculty, 9/13 – present, PT
- New Mexico State Univ., Assoc. Prof., College faculty, 9/11 – 5/13. FT
- New Mexico State Univ., Assoc. Prof & Associate Dean, 9/04 – 9/11, FT
- New Mexico State Univ., Assoc. Prof. & Department Head, 9/03 – 9/04, FT
- New Mexico State Univ., Assoc.Prof. & Associate Dean, 9/02 – 9/03, FT
- New Mexico State Univ., Assoc.Prof. & Assist. Dept. Head, 9/96 – 9/02, FT
- New Mexico State Univ.., Assist. Prof, College faculty, 9/86 – 5/96, FT

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Eastern NM Univ., Computer learning lab director, Supervise student computer labs, 9/80 – 5/83, FT
- Armco Security, Director of data operations, Oversee computerization transition , 9/79 – 9/80, FT
- AAA Security, Computer manager, pversee computerization transition, 5/73 – 9/79, FT

Certification or professional registration

- None (retired)

Membership in professional organizations

- None (retired)

Honors and awards

- None (retired)

Service activities (within and outside of the institution)

- None (retired)

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- None (retired)

Briefly list the most recent professional development activities

- None (retired)

Nadipuram (Ram) R. Prasad

Education - degree, discipline, institution, year

- B.E. Electrical Engineering, Mysore University, India, 1966
- Ph.D. Electrical Engineering, New Mexico State University, 1989

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- NMSU, Assoc. Prof, 1996 – Present, FT
- NMSU, Asst. Prof, 1990 – 1995, FT
- NMSU, College Prof, 1986 – 1989, FT
- Northeastern Univ., Instructor, 1971 – 1975, PT
- Lowell Tech, Instructor, 1973 – 1974, PT

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Amer. Elec. Power (AEP), Planning Manager, R&D in Power Systems, 1976 – 1985, FT
- Chas T. Main, Inc., Senior Engineer, Planning & Development, 1967 – 1975, FT
- General Elec. India, Employee Intern, Power System Design, 1966-1967, FT

Certification or professional registration

- None

Membership in professional organizations

- Member, IEEE, 1972 - Present
- Founding Member, Vietnamese Fuzzy Systems

Honors and awards

- NASA Administrator Fellowship Program (NAFP) Award, Cohort 5, 20012002
- NMSU Bromilow Award for Teaching, 1996

Service activities (within and outside of the institution)

- Faculty Advisor, Indian Students Association and ATO
- U.S. Fulbright Scholar to Vietnam, 2012, Cultural Ambassador

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Tam Nguyen, Nho Nguyen, Nadipuram R, Prasad, “Eliminated Common-Mode Voltage Pulse-width Modulation to Reduce Output Current Ripple for Multilevel Inverters”, IEEE Transactions on Power Electronics, Vol. 31, Issue 8. 2016.
- Tam Nguyen, Nho Nguyen, Nadipuram R, Prasad, “Novel Eliminated CommonMode Voltage PWM Sequences and an Online Algorithm to Reduce Current Ripple for a Three-Level Inverter”, IEEE Transactions on Power Electronics, Vol. 32, Issue 10. 2016.

- Prasad, N. R., Ranade, S. J., Nguyen, H. P., “Low-Head Hydropower Energy Resource Harvesting: Design and manufacture of the (HyPER) Harvester”, Journal of Science & Technology Development, Vol. 18, 2016, ISSN 1859-0128.
- Prasad, N. R., Ranade, S. J., Nguyen, H. P., “Low-Head Hydropower Energy Resource Harvesting: Estimation of maximum harvestable power”, Journal of Science & Technology Development, Vol. 18, 2016, ISSN 1859-0128.
- Prasad, N. R., Ranade, S. J., Nguyen, H. P., Huynh, T. H., “Exploring Low-head Hydropower Energy Resource (HyPER) in waterways of Vietnam” 5th Regional Conference on Advances in Systems and Information, Thailand, July 2013.
- Prasad, N.R., Ranade, S, J., Nguyen, H. P., Huynh, T. H., “Hydropower Energy Recovery (HyPER) from water-flow systems in Vietnam”, 10th International Power and Energy Conference, Ho Chi Minh City, Vietnam, December 12-14, 2012.

Briefly list the most recent professional development activities

- Teaching Academy, Writing to Learn (W2L), Cohort 3, 2016-2018 AY
- Invited Member, Mekong River Commission, Vietnam

Jaime Ramirez-Angulo

Education - degree, discipline, institution, year

- PhD Electrical Engineering, University of Stuttgart, Germany, 1982
- MsC Electrical Engineering, CINVESTAV-IPN, Mexico 1976
- BsC Electrical Engineering, National Polytechnic Institute (ESIME-IPN), Mexico, 1973

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- INAOE, Puebla Mexico, Instructor, Aug 1982- August 1984, FT
- Texas A&M University, College Station TX, Assistant Professor, August 1984- August 1984, FT
- New Mexico State University, Professor, August 1990- December 2017, FT

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- NASA Goddard Space Center, Researcher. Design of charge amplifiers, Summer 2006 and Summer 2007, FT
- NASA Ames Space Center, Researcher Nanoelectronic circuits, Summer 2004, FT
- Texas Instruments, Researcher Design of D/A converters, Summer 2001 and Summer 2002, FT

Certification or professional registration

- Professional Engineer 1974

Membership in professional organization

- Institute of Electrical and Electronic Engineers IEEE

Honors and awards

- IEEE Fellow Member since May 2000
- Westhafer Award for Research Excellence, New Mexico State University
- Distinguished Achievement Award Professor

Service activities (within and outside of the institution)

- Chair of Promotion and Tenure Committee

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- S. Pourashraf, J. Ramírez-Angulo, et al., “An Amplified Offset Compensation Scheme and its Application in a Track and Hold Circuit.” IEEE Transactions on Circuits and Systems II (TCAS-II), April 2017, In print, available online, DOI: 10.1109/TCSII.2017.2695162
- S. Pourashraf, J. Ramírez-Angulo, et al., “Super Class-AB OTA without Open Loop Gain Degradation Based on Dynamic Cascode Biasing.” International Journal of Circuit Theory and Application (IJCTA), In print. DOI: 10.1002/cta.2367

- S. Pourashraf, J. Ramírez-Angulo, et al., "±0.18 V Supply Gate Driven PGA with 0.7 Hz to 2 kHz Constant Bandwidth and 0.15 μW Power Dissipation." IJCTA, Accepted, 2017.
- Garcia-Alberdi, Coro; Lopez-Martin, Antonio J.; Galan, Juan A. and Ramirez-Angulo J Low-Power Analog Channel Selection Filtering Techniques., CIRCUITS SYSTEMS AND SIGNAL PROCESSING Vol. 36 Issue: 3 Pages: 895-915, MAR 2017

Briefly list the most recent professional development activities

- Development of Techniques for Design of Analog and Mixed Signal Circuits in deep submicrometer CMOS Technologies
- Design of Analog Circuits operating from Ultra low supply Voltage

Satish J. Ranade

Education - degree, discipline, institution, year

- B. Sc Physics, Chemistry, Mathematics, Saugar University, India, 1973
- B. E. Electrical, Indian Institute of Science, 1976
- MSEE Electrical, New Mexico State University, 1977
- Ph. D. Electrical, University of Florida, 1981

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State University, Assistant Professor, 1981-1986 , FT
- New Mexico State University, Associate Professor, 1986-1992, FT
- New Mexico State University, Professor, 1992- present, Department Head (2012-2017)

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- ECCO Intl., Consultant, Reliability Modeling, 2015, PT

Certification or professional registration

- none

M*embership in professional organizations*

- IEEE

Honors and awards

- Bromilow Teaching Award, NMSU College of Engineering, 2012
- Energy Engineer of the Year, NMAEE, 2013
- Klipsch Distinguished Professor 1998-
- PNM Chair Professor, 2002-

Service activities (within and outside of the institution)

- TCPC, Secretary, Vice-chair, Chairman IEEE PES Transmission and Distribution Committee
- Chair, IEEE PES Career Promotion Subcommittee, Education Committee

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Wei Zhang, Ye Ma, Wenxin Liu, and Satish Ranade, "Distributed Optimal Active Power Dispatch under Constraints for Smart Grids," IEEE Transactions on Industrial Electronics, June 2017, Volume: 64, Issue:6, pp. 5084-5094, DOI 10.1109/TIE.2016.2617821
- Ye Ma, Satish Ranade, Jose Tabarez, Ankith Nadella, Nataraj Pragllapati, Wenxin Liu "Stochastic Distributed Energy Resource Management", 7th. ICMS 2017, 21-23 December, 2017, Pune, India.

Briefly list the most recent professional development activities

- ABET Workshop, ECE Department Heads Association, Destin, FL, 2017
- Several presentations at the NMSU teaching Academy
- USDOE Energy Storage Systems Program, Peer Reviewer 2012-2016, Peer Review Participant 2017

Steven Sandoval

Education - degree, discipline, institution, year

- B.S. Electrical Engineering, New Mexico State University, 2007
- M.S. Electrical Engineering, New Mexico State University, 2010
- Ph. D Electrical Engineering, Arizona State University, 2016 3

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State University, Assistant Professor, 2016-present. FT
- New Mexico State University, Affiliate Faculty, 2016, PT

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Cirrus Logic Signal Processing, Research Intern, Progress Research, 2016, PT
- Atamir-WSMR, Systems Analyst, Test Reporting/ Documentation, 2008-2016, FT
- NCI Info. Systems Inc., Systems Analyst, Test Reporting/ Documentation, 2007-2008, FT
- Honeywell Int. Inc, Student Engineer, Industry Internship, 2006, FT

Certification or professional registration

- N/A

Membership in professional organizations

- Member, Institute of Electrical and Electronics Engineers (IEEE)
- Member, Acoustical Society of America (ASA)

Honors and awards

- Minority Fellowship, Acoustical Society of America (ASA)
- Minority Doctoral, New Mexico Higher Education Department

Service activities (within and outside of the institution)

- Member, Engineering Research Distinguished Lecturer Committee
- Member, Graduate Admissions Committee 2017-Present

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- S. Sandoval, V. Berisha, R. L. Utianski, J. M. Liss, and A. Spanias, “Automatic assessment of vowel space area,” The Journal of the Acoustical Society of America, vol. 134, no. 5, pp. EL477-EL483, 2013
- L. E. Boucheron, P. L. De Leon, and S. Sandoval, “Low Bit-Rate Speech Coding through Quantization of Mel-Frequency Cepstral Coefficients,” Audio, Speech, and Language Processing, IEEE Transactions on, vol.20, no.2, pp.610-619, Feb. 2012

- S. Sandoval, P. L. DeLeon, and J. M. Liss, “Hilbert Spectral Analysis of Vowels using Intrinsic Mode Functions,” IEEE Automatic Speech Recognition and Understanding Workshop (ASRU), 2015
- S. Sandoval, & P.L. De Leon "Advances in Empirical Mode Decomposition for computing Instantaneous Amplitudes and Instantaneous Frequencies." Acoustics, Speech and Signal Processing (ICASSP), 2017 IEEE International Conference on. IEEE, 2017.

Recent professional development activities

- N/A

Steven Stochaj

Education - degree, discipline, institution, year

- PhD Physics, University of Maryland,1990
- BA Physics and Mathematics, Franklin and Marshall, 1987

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- NMSU, Professor 2005 – Present, FT
- NMSU, Associate Professor, 2001 – 2005, FT
- NMSU, Assistant Professor, 1995 – 2001, FT
- NMSU, College Professor, 1990 – 1994, FT

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- none

Certification or professional registration

- none

Membership in professional organizations

- IEEE
- ASEE

Honors and awards

- none

Service activities (within and outside of the institution)

- College P&T Committee
- Regents' Budget Committee

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Thelen, A.E., Chanover, n., Murphy, J., Rankin, K., and Stochaj, S. "A Europa CubeSat Concept Study for Measuring Atmospheric Density and Heavy Ion Flux" JoSS, Vol. 06, No. 02 (August 2017) pp. 591607
- Bruno, A., et al. "Geomagnetically trapped, albedo and solar energetic particles: trajectory analysis and flux reconstruction with PAMELA." Advances in Space Research (2016).
- Bruno, A., et al. "The May 17, 2012 solar event: back-tracing analysis and flux reconstruction with PAMELA." Journal of Physics: Conference Series. Vol. 675. No. 3. IOP Publishing, 2016.
- Adriani, O., et al. "Pamela?s measurements of magnetospheric effects on high-energy solar particles." The Astrophysical Journal Letters 801.1 (2015): L3.

- Martucci, Matteo, et al. "Analysis on H spectral shape during the early 2012 SEPs with the PAMELA experiment." Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment 742 (2014): 158-161. 10.

Briefly list the most recent professional development activities

- none

Wei Tang

Education - degree, discipline, institution, year

- B.S. Microelectronics, Peking University, 2006
- Ph.D. Electrical Engineering, Yale University, 2012

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State University, Assistant Professor, 2012-Present, FT
- Nanyang Technological Univ., Visiting Scholar, NSF Sensor Research, Dec 2015, PT

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- none

Certification or professional registration

- none

Membership in professional organizations

- Member, IEEE

Honors and awards

- NSF Faculty Early Career Award, 2017

Service activities (within and outside of the institution)

- Member, Graduate Study Committee, 2016-Present

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Djuro Zrilic, Grozdan Petrovic, Wei Tang: “Novel Solutions of Delta-Sigma Based Rectifying Encoder”. IEEE Transactions on Circuits and Systems – II Express Briefs (TCAS-II). vol 64, no. 10. pp. 1242-1246, October 2017.
- Xiaochen Tang, Qisong Hu, Wei Tang: “Delta-Sigma Encoder for Low Power Wireless Bio-sensors using Ultra Wideband Impulse Radio”. IEEE Transactions on Circuits and Systems – II Express Briefs (TCAS-II). vol 64, no. 7, pp. 747-751, July 2017.
- Qisong Hu, Xiaochen Tang, Wei Tang: “Integrated Asynchronous Ultra Wideband Impulse Radio with Automatic Clock and Data Recovery”. IEEE Microwave and Wireless Components Letters (MWCL). vol 27, no. 4, pp. 416-418, April 2017.
- Hang Yu, Wei Tang, Menghan Guo, Shoushun Chen: “A Two-Step Prediction ADC Architecture for Integrated Low Power Image Sensors”. IEEE Transactions on Circuits and Systems – 1 Regular Paper (TCAS-I), vol. 64, no. 1, pp.50-60, January 2017.

Briefly list the most recent professional development activities

- Organizer of Graduate Student Seminar of ECE

David G. Voelz

Education - degree, discipline, institution, year

B.S. Electrical Engineering, New Mexico State University, 1981
M.S. Electrical Engineering, University of Illinois, 1983
Ph.D. Electrical Engineering, University of Illinois, 1987

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State University, Professor, 2010-Present, FT
- New Mexico State University, Associate Professor, 2001-2010, FT

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Air Force Research Laboratory, Engineer/ Scientist – Principal Investigator, Imaging and remote sensing research, 1987-2001, FT

Certification or professional registration

- None

Membership in professional organizations

- International Society for Optics and Photonics (SPIE)
- Optical Society of America (OSA)

Honors and awards

- Fellow of the Optical Society of America (OSA), 2015
- Distinguished Career Award NMSU - University Research Council, 2010
- Paul W. and Valerie Klipsch Professorship, 2007
- Bromilow Award for Research Excellence, NMSU College of Eng., 2007
- Fellow of the International Society for Optics and Photonics (SPIE), 1999
- Engineering Excellence Award, Optical Society of America, 1995
- Giller Award - Technical Achievement, Air Force Research Lab, 1988

Service activities (within and outside of the institution)

- Chair, Free-Space Laser Communication and Laser Imaging Conference, SPIE, 2001-2005
- Member, Rudolph Kingslake Medal Committee, SPIE, 2001-Present
- Program Committee, SPIE and OSA Conferences (32), 1992-Present
- Short Course Instructor, Computational Fourier Optics, SPIE Symposia, 2012-Present

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- X. Xiao, D. G. Voelz, S. R. Bose-Pillai, and M. W. Hyde, "Modeling random screens for predefined electromagnetic Gaussian–Schell model sources," Opt. Express 25, 3656-3665 (2017).

- H. Zhan, D. G. Voelz. Modified polarimetric bidirectional reflectance distribution function with diffuse scattering: surface parameter estimation. Opt. Eng., 55(12), 123103–123103 (2016).
- D. Voelz, X. Xiao, and O. Korotkova, "Numerical modeling of Schell-model beams with arbitrary far-field patterns," Opt. Lett. 40, 352-355 (2015).
- Hyde, Milo W. and Basu, Santasri and Voelz, David G. and Xiao, Xifeng, "Experimentally generating any desired partially coherent Schell-model source using phase-only control, Journal of Applied Physics, 118, 093102 (2015).

Briefly list the most recent professional development activities

- None

Department of Chemical & Materials Engineering – Faculty CVs

Engineering Physics Program

(Bachelor of Science in Engineering Physics)

at

New Mexico State University

Tenured & Tenure-Track Faculty – Department of Chemical & Materials Engineering

Paul K. Andersen

Education – degree, discipline, institution, year

- Ph.D., Chemical Engineering, University of California-Berkeley (1987)
- B.S., Chemical Engineering, Brigham Young University (1981)

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State University, Associate Professor (1997 to present)
- New Mexico State University, Institute for Energy & the Environment, Executive Director (2015–2016)
- Purdue University, Assistant/Associate Professor (1987–1997)
- Lawrence Berkeley Laboratory, Materials and Molecular Research Division, Berkeley, CA Graduate research assistant. (January 1982 to December 1987).

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Bechtel Petroleum, Slurry Pipeline Group, San Francisco, CA (Summer 1980; June 1981 to January 1982).

Certifications or professional registrations

- None

Current membership in professional organizations

- None

Honors and awards

- None

Service activities (within and outside of the institution)

- NMSU Faculty Senate
- Provost's General Education Task Force
- CHME PhD Qualifying Examination Coordinator

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- K. Andersen (2018). *Electric Power*: *Energy Sources, Power Plants, and Electrical Grids*. Boca Raton, FL: CRC Press (under contract).
- K. Andersen, M. G. Scarbrough, and J. P. Andersen (2018). *Essential C*, 2nd ed. Cary, NC: Oxford University Press (in preparation).
- Xu, L. Fei, E. Fu, Q. Lin, B. Yuan, J. Hill, S. Deng, P. K. Andersen, Y. Wang, and H. M. Luo. (2013). "A general polymer-assisted solution approach to grow transition metal oxide nanostructures directly on nickel foam as anodes for Li-ion batteries." *Journal of Power Engineering*, 242, 604–609.
- Xu, R. Yi, B. Yuan, Q. Lin, L. Fei, S. Deng, P. K. Andersen, D. Wang, and H. M. Luo. (2012) "High Capacity MoO_2/Graphite Oxide Composite Anode for Lithium-Ion Batteries," *Journal of Physical Chemistry Letters*, 3(3), 309–314.

- H. Munson-McGee, A. Mannarswamy, and P. K. Andersen (2011). “D-optimal Designs for Sorption Kinetics Experiments: Slabs,” *Journal of Food Engineering*, 104(3), 461–466.
- H. Munson-McGee, A. Mannarswamy, and P. K. Andersen (2011). “D-optimal Designs for Sorption Kinetics Experiments: Cylinders,” *Journal of Food Engineering*, 104(2), 202–207.
- H. Munson-McGee, A. Mannarswamy, and P. K. Andersen (2010). “Designing Experiments to Differentiate between Adsorption Isotherms using T-optimal Designs,” *Journal of Food Engineering*, 101(4), 386–393.
- Mannarswamy, S. H. Munson-McGee, and P. K. Andersen (2010). “D-optimal Designs for the Cross Viscosity Models Applied to Guar Gum Mixtures,” *Journal of Food Engineering*, 97(3), 403–409.
- Mannarswamy, S. H. Munson-McGee, R. Steiner, and P. K. Andersen (2009). “D-optimal Experimental Designs for Freundlich and Langmuir Adsorption Isotherms.” *Chemometrics and Intelligent Laboratory Systems*, 97, 2, 146–151.

Briefly list the most recent professional development activities

- NMSU Teaching Academy, Evidence-Based Instructional Practices (July–August 2017)
- NMSU Teaching Academy, Excel at teaching (April 2017)
- NMSU OGC, Principal Investigator Training (April 2017)
- NMSU OCIP: Creating Whiteboard Videos (March 2017)
- NMSU Annual Compliance Training (November 2016)
- NMSU Laboratory Safety Refresher (October 20016)
- NMSU Basic Radiation Safety (August 2016).

Catherine E. Brewer

Education – degree, discipline, institution, year

- Ph.D., Iowa State University, Chemical Engineering and Biorenewable Resources & Technology (2012)
- B.S., Chemistry, Indiana University of Pennsylvania Indiana (2007)

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State University, Assistant Professor, 2013-present, full time
- Rice University, Postdoctoral Research Associate, 2012-2013, full time
- Iowa State University, Graduate Research and Teaching Assistant, 2007-2012, part time
- Indiana University of Pennsylvania, Undergraduate Research Assistant, 2006-2007, part time

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- n.a.

Certifications or professional registrations

- n.a.

Current membership in professional organizations

- American Institute of Chemical Engineers
- American Society of Agricultural & Biosystems Engineers
- International Biochar Initiative
- Pink Boots Society

Honors and awards

- NMSU University Research Council Early Career Research Award, 2017
- 2nd Place, Dark & Malty Category, AICHE Young Professionals 1st Annual Brewing Competition, 2017
- ISU Graduate College Teaching Excellence Award, 2012
- ISU Bioeconomy Institute George Washington Carver Award, 2011
- AICHE Forest & Bioproducts Division Student Research Travel Award, 2011
- ISU James R. Katzer Graduate Research in Energy Fellow, 2011-2012
- National Science Foundation Graduate Research Fellow, 2008-2011
- ISU Plant Sciences Institute Graduate Research Fellow, 2007-2008, 2011-2012

Service activities (within and outside of the institution)

- Journal Peer Reviewer for *Biomass & Bioenergy, Bioresource Technology, Environmental Progress & Sustainable Energy, Bioenergy Research*, *Industrial Crops & Products,* and several others
- Proposal Review Panelist and Ad Hoc Reviewer for the National Science Foundation and the USDA, 2013-present
- Session Chair, Forest & Bioproducts Division, AICHE Annual Meetings, 2013-present
- Young Professionals Director, AICHE Rio Grande Local Section, 2017-present

- Undergraduate Research Scholar Selection Committee, NM Alliance for Minority Participation, New Mexico State University, 2015-present
- Session Presenter, NMSU Pre-Engineering Summer Academy for Middle School and High School Students, 2016-present
- Outreach Session Leader and Volunteer, Expanding Your Horizons (for Middle School Girls), New Mexico State University, 2014-present
- Library Faculty Liaison, Department of Chemical & Materials Engineering, New Mexico State University 2016-present
- Faculty Advisor, Chemical Engineering Graduate Student Organization, New Mexico State University, 2013-present

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Amiri, A., Al-Rawajfeh, A., Brewer, C.E. (2018) Simulation of small-scale thermal water desalination using biomass energy, *Desalination & Water Treatment*, accepted, in press.
- Cheng, F., Cui, Z., Chen, L., Jarvis, J., Paz, N., Schaub, T., Nirmalakhandan, N., Brewer, C.E. (2017) Hydrothermal liquefaction of high- and low-lipid algae: bio-crude oil chemistry, *Applied Energy*, 206, 278-292, DOI: 10.1016/j.apenergy.2017.08.105.
- Idowu, O.J., Sanogo, S., Brewer, C.E. (2017) Short term impacts of pecan waste byproducts on soil quality in texturally different arid soils, *Communications in Soil Science & Plant Analysis,* 48 (15), 1781-1791, DOI: 10.1080/00103624.2017.1395448.
- Wang, K., Zheng, Y., Zhu, X., Brewer, C.E., Brown, R.C. (2017) Ex-situ catalytic pyrolysis of wastewater sewage sludge—a micro-pyrolysis study, *Bioresource Technology*, 232, 229-234, DOI: 10.1016/j.biortech.2017.02.015.
- Cheng, F., Brewer, C.E. (2017) Producing jet fuels from biomass lignin: potential pathways to alkyl-benzenes and cycloalkanes, *Renewable and Sustainable Energy Reviews*, 72, 673-722, DOI: 10.1016/j.rser.2017.01.030.
- Brewer, C.E., Hall, E.T., Schmidt-Rohr, K., Laird, D.A., Brown, R.C., Zygourakis, K. (2016) Temperature and reaction atmosphere effects on properties of corn stover biochar, *Environmental Progress & Sustainable Energy*, 36(3), 696-707, DOI: 10.1002/ep.12503.
- Zhang, Y., Idowu, O.J., Brewer, C.E. (2016) Using agricultural residue biochar to improve soil quality of desert soils, *Agriculture*, 6 (1), 10, DOI: 10.3390/agriculture6010010.
- Brewer, C.E., Chuang, V.J., Masiello, C.A., Gonnermann, H., Gao, X., Dugan, B., Driver, L.E., Panzacchi, P., Zygourakis, K., Davies, C. (2014) New approaches to measuring biochar density and porosity, *Biomass & Bioenergy*, 66, 176-185.

Briefly list the most recent professional development activities

- Web-Based Concise Course in Brewing Technology, Siebel Institute of Technology, Aug-Nov 2017
- Summer School for Chemical Engineering Faculty, American Society of Engineering Education, July-Aug 2017
- National Science Foundation Innovation Corps, July-August 2016
- Publish & Flourish and Team Mentoring Program, Teaching Academy, New Mexico State University, 2013-2015

Reza Foudazi

Education – degree, discipline, institution, year

- Ph.D. Chemical Engineering, Cape Peninsula University of Technology (2010)
- M.Sc. Polymer Engineering, Amirkabir University of Technology (2004)
- B.Sc. Polymer Engineering, Amirkabir University of Technology (2002)

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- Assistant Professor, Department of Chemical and Materials Engineering, New Mexico State University, New Mexico (August 2013 – date). Full time
- Visiting Faculty, The University of Minnesota Materials Research Science and Engineering Center (MRSEC), Minnesota (June 2016 – August 2016). Full time
- Research Associate, Department of Macromolecular Science and Engineering, Case Western Reserve University, Cleveland, Ohio (June 2011 – August 2013). Full time
- Postdoctoral Fellow, Material Science and Technology group, Cape Peninsula University of Technology, Cape Town, South Africa (Jan. 2010 – May 2011). Full time

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- n.a.

Certifications or professional registrations

- n.a.

Current membership in professional organizations

- Society of Rheology, SoR (2010 – present)
- American Chemical Society, ACS (2012 – present)
- American Institute of Chemical Engineers, AIChE (2013 – present)
- Iranian Society of Rheology (2015 – present)
- North American Membrane Society (2015 – present)
- Royal Society of Chemistry, UK (2016 – present)

Honors and awards

- University Research Council, Early Career Award, New Mexico State University (2016)
- Recognized in the Mentoring Excellence program of New Mexico State University (2016)
- PPG Award for Applied Polymer Excellence (2012)

Service activities (within and outside of the institution)

- Member of the team participated in Making Academic Change Happen (MACH) workshop for implementing ENG 100 course for freshmen (2014)
- Organizer of Graduate Weekly Seminar at Chemical Engineering Department of NMSU (2014 – 2015)
- Adviser of local high school students for research experience (2014 – 2015)
- Academic Adviser of Iranian Students Organization (ISO) at NMSU (2014 – 2015)

- Academic Adviser of National Society of Professional Engineers at NMSU (2015 – 2016)
- Member of Founding Board of Iranian Society of Rheology (2015 – present)
- Developed and taught "Introduction to Rheology and Viscoelasticity" workshop, NMSU RISE (Research Initiative for Scientific Enhancement) to the Postdoctorate Program (2016)

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- C. Kuang, S. Qavi, R. Foudazi, "Double-stage phase separation in dynamically asymmetric ternary polymer blends", RSC Advances 6, 92104-92114, 2016.
- N. Khazeni, R. Foudazi, A. Ghassemi, "Zn(NH3)(CO3) inorganic helical framework for selective separation of carbon dioxide", Chemical Engineering Journal 304, 369-375, 2016.
- A. Ghorbani, A. Ghassemi, P.K. Andersen, R. Foudazi, "A Prediction Model of Mass Transfer through an Electrodialysis Cell", Desalination and Water Treatment 57, 22290-22303, 2016.
- R. Zowada, R. Foudazi, "Poly(high internal phase emulsions) as supersorbent hydrogels", 252nd American Chemical Society National Meeting & Exposition, August 21-25, 2016, Philadelphia, PA.\
- R. Zowada, A. Malakian, R. Foudazi, "Arsenic Removal from Water by Porous Polymers", 2015 AIChE Annual Meeting, Poster Presentation, November 8-13, 2015, Salt Lake City, UT.
- A. Malakian, R. Zowada, R. Foudazi, "High Internal Phase Emulsion Templating As a Potential Method for Producing Ultrafiltration Membranes", 2015 North American Membrane Society Meeting, Poster Presentation, May 30 – June 3, 2015, Boston, MA.
- S. Qavi, C. Kuang, R. Foudazi, "Mesophase Templated Porous Polymers As Ultrafiltration Membranes", 2015 North American Membrane Society Meeting, Poster Presentation, May 30 – June 3, 2015, Boston, MA.
- R. Foudazi, C. Bezik, D. Feke, S. Rowan, I. Manas-Zloczower, "Method for the Production of High Internal Phase Emulsion Foams", US Patent 2015/0353699 A1. Dec. 10, 2015.

Briefly list the most recent professional development activities

- University of Minnesota MRSEC Fellowship, University of Minnesota, Minneapolis, MN (2016)
- The Online Course Improvement Program (OCIP): Let's Talk Online Teaching, NMSU Teaching Academy (2016)
- QEM/NSF Career Workshop, Quality Education for Minorities (QEM) Network (March 2015)
- Creating Your FLiP Course Abroad, NMSU Teaching academy (2014)
- Making Academic Change Happen (MACH), Rose-Hulman Institute of Technology (2014)
- i>Clicker Training, NMSU Teaching academy (2014)
- Flipping the Classroom with Just-in-Time Teaching, NMSU Teaching Academy (2014)

Jessica P. Houston

Education – degree, discipline, institution, year

- Ph.D., Chemical Engineering, Texas A&M University (2005)
- B.S., Chemical Engineering, New Mexico State University (2000)

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- Associate Professor, Chemical & Materials Engineering, May 2015 – Present
- Associate Professor, Molecular Biology, Aug 2009 – Present
- Associate Department Head Chemical & Materials Engineering, August 2012 – May 2014
- Assistant Professor, Chemical Engineering, Aug 2009 – May 2014

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Director's Postdoctoral Fellow, Los Alamos National Laboratory, May 2006 – Aug 2009

Certifications or professional registrations

- n.a.

Current membership in professional organizations

- International Society for the Advancement of Cytometry
- American Institute of Chemical Engineers
- Optical Society of America

Honors and awards

- 2018-2019 Fulbright Scholar, The Council for International Exchange of Scholars and Japan-U.S. Educational Commission
- 2017 Synergy-One Award Faculty Award, NMSU College of Engineering
- 2015 Best Paper Award for 2014 Cytometry Part A, John Wiley and Sons,
- 2014 College of Engineering Foreman Award: Assistant Professor Level, NMSU
- 2014 New Mexico State University University Research Council Early Career Award
- 2014 Scholar Award; the International Society for the Advancement of Cytometry

Service activities (within and outside of the institution)

- Aggie Innovation Space Faculty Advisory Committee Member 2013 – present
- Biomedical Engineering Society · Faculty advisor, 2015 – present
- Cytometry Part A, Associate Editorial Board Member, 2017 – present
- Engineering Club Mentor/Organizer Las Cruces Academy, 2015 – present
- MAES · Faculty advisor, 2015 – present
- Referee, Journal of Biomedical Optics, Optics Express, Scientific Reports, Journal of Biomedical Optics Express, Applied Optics, Sensors, International Journal of Molecular Sciences, Methods and Applications in Fluorescence, Department of Energy Office of Science; Journal of Undergraduate Research, AAPS PharmSciTech, Advanced Healthcare Materials

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- F. Alturkistany, K. Nichani, W. Li, and J. P. Houston, "Effect of Viscosity on Fluorescence Lifetime Measured Using Flow Cytometry," Conference on Lasers and Electro-Optics, OSA Technical Digest, 2018, Optical Society of America, 2018
- J. Li and J. P. Houston, "A Novel Cell and Particle Sorting Approach Based on Fluorescence Dynamics, Conference on Lasers and Electro-Optics, OSA Technical Digest, 2018, Optical Society of America, 2018
- J. P. Houston, Z. Yang, J. Sambrano, K. Nichani, and G. Vacca, "Overview of fluorescence lifetime measurements in flow cytometry," <u>Flow cytometry Protocols</u> Edition 4Eds. B. Hawley and T. Hawley, Springer 2017.
- A. Filby, and J. P. Houston "Imaging cytometry: Automated morphology and feature extraction," Cytometry A. 2017 Sep;91(9):851-853. doi: 10.1002/cyto.a.23200
- J. P. Houston and M. Naivar U.S. SN 14/072,521: Methods of measuring fluorescence lifetime with a flow cytometer," U.S. Patent, Awarded 2017 via Group Art Unit 1777
- J. Sambrano, Y. Smagley, A. Chigaev, L. A. Sklar, and J. P. Houston, "Using FRET to quantify changes in integrin structures in human leukocytes induced by chemoattractants with multi-frequency flow cytometry," Proc. SPIE 10062, Optical Interactions with Tissue and Cells XXVIII, 100620X, February 15, 2017.
- Z. Yang, J. Houston, B. Rutherford, R. McDonald, "Development of far-red and ultraviolet digital frequency-domain flow cytometry systems," IEEE Journal of Selected Topics in Quantum Electronics, 2017, Volume: 23, Issue: 0 doi: 10.1109/JSTQE.2017.2649463
- W. Li, K. D. Houston, and J. P. Houston, "Shifts in the fluorescence lifetime of EGFP during bacterial phagocytosis measured by phase-sensitive flow cytometry," Sci Rep., 2017, Jan 16;7:40341. doi: 10.1038/srep40341.
- Z. Yang, D. M. Shcherbakova, V. Verkhusha, and J. P. Houston, "Time-resolved flow cytometry for lifetime measurements of near-infrared fluorescent proteins," in Conference on Lasers and Electro-Optics, OSA Technical Digest, 2016, (Optical Society of America, 2016), paper SW4G.1.

Briefly list the most recent professional development activities

- Teaching and Learning STEM, NMSU Teaching Academy, 01/13/2017 – 03/15/2017
- "Just Teaching, Scholarly Teaching and Education Research. Where do you want to be, and how do you get there?", NMSU Teaching Academy 01/24/2017
- STEM Women's Book Club, 01/01/2016 – 12/31/2016
- "Teaching in NMSU's First Technology-Enhanced Active Learning (TEAL) Classroom" NMSU Teaching Academy, 10/06/2015 – 10/27/2015
- STEM Women's Book Club, 01/01/2015 – 12/31/2015
- "Mentoring in the professoriate: Experiences of a mentor and protégé", NMSU Teaching Academy 09/21/2015
- "Using Adobe Connect in Canvas" NMSU Teaching Academy 08/27/2015
- "Campus Climate for Underrepresented Faculty Members" NMSU Teaching Academy 03/20/2015
- "Working the Student Retention Puzzle" NMSU Teaching Academy 03/02/2015
- STEM Women's Book Club, NMSU Teaching Academy 01/01/2014 – 12/31/2014

Umakanta Jena

Education – degree, discipline, institution, year

- Ph.D., University of Georgia, Biological and Agricultural Engineering (2011)
- M. Tech., Agricultural Engineering, Indian Institute of Technology Kharagpur (2002)
- B. Tech., Agricultural Engineering, Orissa University of Agriculture and Technology (2001)

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- New Mexico State University, Assistant Professor, August 2016-present, full time
- Lincoln University of Missouri, Assistant Professor, Jan 2016-July 2016, full time
- Desert Research Institute, Assistant Research Professor, Nov 2013-Jan 2016, full time
- Desert Research Institute, Postdoctoral Fellow, Oct 2012-Oct 2013, full time
- University of Georgia, Postdoctoral Research Associate, May 2011-Sept 2012, full time

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Sardar Patel Renewable Energy Research Institute, Sept 2003-July 2006, full time
- The Energy Resources Institute, Research Intern, May 2002-Dec 2002, part time

Certifications or professional registrations

- n.a.

Current membership in professional organizations

- American Institute of Chemical Engineers
- American Society of Biological and Agricultural Engineers
- Institute of Biological Engineering
- Indian Society of Agricultural Engineers

Honors and awards

- Nell J. Redfield Foundation Fellow in Renewable Energy in Nevada, 2012
- Grant H. Flint International Scholarship Award by the Solid Waste Association of North America, 2009
- Excellence in Sustainable Development Research and Study, Air & Waste Management Association, 2009

Service activities (within and outside of the institution)

- Journal Peer Reviewer for Algal Research, Applied Energy, ASABE Transactions, Chemical Engineering Research and Design, Chemosphere, Bioresource Technology, Biofuels, Energy & Environmental Science, Energies, Bioenergy Research, and several others
- Proposal Review Panelist and Ad Hoc Reviewer for the National Science Foundation, U.S. Department of Energy, US. Department of Agriculture and, Portugal Science Foundation 2012-present
- Associate Editor, Frontiers in Energy Research journal 2017-present

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Jena, U., S.K. Hoekman (2017) Recent Advancements in Algae-to-Biofuels Research - Novel Growth Technologies and Conversion Methods, Edited by U. Jena and S.K. Hoekman, *Frontiers in Energy Research* 5:2
- Ekefre, D.E., A.K. Mahapatra, M. Latimore, Jr., D.D. Bellmer, U. Jena, G.J. Whitehead, A. L. Williams (2017). Evaluation of three varieties of sweet sorghums as feedstocks for bioethanol production, Heliyon 3:1-18
- Mahapatra, A.K., D. E. Ekefre, N. Pattanaik, U. Jena, M. Latimore, Jr., D.D. Bellmer (2017) Thermal Properties of Sweet Sorghum Bagasse as a Function of Moisture Content. Agricultural Engineering International: CIGR Journal, 19 (4): 108-113
- Leelah, S., A. Mudhoo, U. Jena, Schmidt, J. E. (2017) Insights into green biotechnology for sustainable bioethanol production from lignocellulosic biomass, International Conference on Energy, Environment and Climate, Mauritius, July 5-7, 2017
- Brewer, CE, K. Mallick, F. Cheng, Z. Cui, SMH Gedara, M. Karbakhshravari, TM Schaub, U.Jena, N. Nirmalakhandan (2017). Hydrothermal Liquefaction of Galdieria sulphuraria Grown on Municipal Wastewater. American Society of Agricultural and Biological Engineering Annual International Meeting, Spokane WA, July 16-19, 2017
- Soliz, N., C.E. Brewer, U. Jena, M. Audu, K. Garland, T. Le-Doux, L. Derry, C. M.Bejanaro. Hydrothermal Liquefaction of Filamentous Algae, NSF RENUWit Young Scholars Research Symposium, Las Cruces, NM, June 30, 2017.
- Jena, U. Bioenergy from Algal Biomass and Conversion Processing, Indo-US. WEF Nexus Workshop, Indian Institute of Science, Bangalore, India, April 11-14, 2017.
- Costanzo, W., R.N. Hilten, U. Jena, K.C. Das, J.R. Kastner (2016) Effect of low temperature hydrothermal liquefaction on catalytic hydrodenitrogenation of algae biocrude and model macromolecules, *Algal Research*, 13: 53-68
- Jena, U., A. McCurdy, Hailey Summers, S. Kent Hoekman, L. Seefeldt, J. Quinn, Co-solvent hydrothermal liquefaction of oleaginous yeast biomass. Oral presentation at the 2016 AIChE Annual Meeting, San Francisco, CA, November 12-18, 2016
- Mallick, K., U. Jena, F. Cheng, F., S.H., C.E. Brewer, N. Nirmalakhandan, Different Parameters Controlling the Biocrude Yield in Hydrothermal Liquefaction of Microalgae. 2016 AIChE Annual Meeting, San Francisco, CA, November 12-18, 2016

Briefly list the most recent professional development activities

- Scholarly Writing Retreat Summer, Teaching Academy, New Mexico State University, 2017
- Online Course Improvement Program-Summer Institute I, Teaching Academy, New Mexico State University, 2017
- Publish & Flourish: Become a Prolific Scholar, Teaching Academy, New Mexico State University, 2016
- Proposal Development Workshops, Office of Research Development, New Mexico State University, 2016-2017
- Team Mentoring for Faculty, NMSU Teaching Academy, 2016

Hongmei Luo

Education – degree, discipline, institution, year

- Ph. D., Chemical Engineering, Tulane University (2006)
- M.S., Materials Science and Engineering, University of Science and Technology of China (1995)
- B.S., Chemistry, Fuyang Normal University, China (1992)

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- Associate Professor, Department of Chemical and Materials Engineering, NMSU, 08/2014 – Present, full time
- Graduate program coordinator, Department of Chemical and Materials Engineering, NMSU, 02/2010 – Present, part time
- Assistant Professor, Department of Chemical Engineering, NMSU, 08/2009 – 08/2014, full time
- Postdoctoral Associate, Los Alamos National Laboratory, 06/2006 – 08/2009, full time

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- n.a.

Certifications or professional registrations

- n.a.

Current membership in professional organizations

- International Association of Advanced Materials
- American Chemical Society
- Electrochemical Society
- Materials Research Society

Honors and awards

- 2016 Robert L. Westhafer Award for Excellence in Research and Creative Activity, NMSU
- 2016 Distinguished Career Award from University Research Council for Exceptional Achievements in Creative Scholarly Activity, NMSU
- 2016 Nanoscience Research Leader Award, Publishing Division of Cognizure
- 2015 Advisor for the Chinese Government Award for Outstanding Self-financed Students Abroad, China Scholarship Council, for Gen Chen's Ph.D study at NMSU
- 2015 Outstanding Reviewer for the Journal of Power Sources, Elsevier, Netherlands
- 2015 Bromilow Award for Research Excellence, NMSU College of Engineering

Service activities (within and outside of the institution)

- University Research Council member, NMSU (2014 – 2016)
- The Engineering Physics Committee member (2014 – present)

- Journal Peer Reviewer for Environmental Science & Technology, Advanced Materials, Angew Chemie, JACS, ACS Nano, ACS Applied Materials & Interfaces, J. Power Sources, Nanoscale, Adv. Functional Mater.; Nano Energy and several others, 2006 – present
- Editorial Board Member, Applied Materials Today, The Scientific Pages of Nanotechnology, Chemical Engineering
- Guest Editor, J. Nanomaterials, J. Nanotechnology, 2011 – 2017

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Gen Chen, Litao Yan, Hongmei Luo, Shaojun Guo, Nanoscale Engineering of Heterostructured Anode Materials for Boosting Lithium Ion Storage, Adv. Mater. 28, 7580-7602 (2016)
- G. Chen, S. Wang, R. Yi, L. Tan, H. Li, M. Zhou, L. Yan, Y. Jiang, S. Tan, D. Wang, S. Deng, X. Meng, H. M. Luo, Facile synthesis of hierarchical MoS2-carbon microspheres as robust anode for lithium ion battery, J. Mater. Chem. A 4, 9653-9660 (2016)
- L. Yan, G. Chen, S. Sarker, S. Richins, H. Wang, W. Xu, X. Rui, H. M. Luo, Ultrafine Nb2O5 Nanocrystal Coating on Reduced Graphene Oxide as Anode Material for High Performance Sodium Ion Battery, ACS Appl. Mater. Interfaces 8, 22213-22219 (2016)
- Litao Yan, Xianhong Rui, Gen Chen, Weichuan Xu, Guifu Zou, Hongmei Luo, Recent advances in nanostructured Nb-based oxides for energy storage, Nanoscale 8, 8443-8465 (2016)
- L. Yan, G. Chen, S. Tan, M. Zhou, G. Zou, S. Deng, S. Smirnov, H. M. Luo, Titanium Oxynitride Nanoparticles Anchored on Carbon Nanotubes as Energy Storage Materials, ACS Appl. Mater. Interfaces 7, 24212-24217 (2015).
- Q. Lin, N. S. Makarov, W-k. Koh, K. A. Velizhanin, C. M. Cirloganu, H. M. Luo, V. I. Klimov, J. M. Pietryga, The design and synthesis of heterostructured quantum dots with dual emission in the visible and infrared, ACS Nano 9 (1), 539-547 (2015).
- G. Chen, M. Zhou, J. Catanach, T. Liaw, L. Fei, S. Deng, H. M. Luo, Solvothermal route based in situ carbonization to Fe3O4@C as anode material for lithium ion battery, Nano Energy 8, 126-132 (2014).
- C. M. Cirloganu, L. A. Padilha, Q. Lin, N. Makarov, K. Velizhanin, H. M. Luo, I. Robel, J. M. Pietryga, V. I. Klimov, Enhanced carrier multiplication in engineered quasi-type-II quantum dots, Nature Commun. 5, 4148 (2014).
- G. Chen, F. Chen, X. H. Liu, W. Ma, H. M. Luo, J. Li, R. Z. Ma, G. Z. Qiu, Hollow spherical rare-earth-doped yttrium oxysulfate: a novel structure for upconversion, Nano Research, 7, 1093 (2014).

Briefly list the most recent professional development activities

- Pathway toward Degree Completion, monthly, NMSU graduate school (2014 – present)
- Promotion to Full Professor Spring Workshop, Teaching Academy, 2017
- The Quiz tool in Canvas, Teaching Academy, 2016
- Writing to Learn Mini-Grant Recipients: A Panel, Teaching Academy, 2016
- 10 Ways to Manager Your Time, Teaching Academy, 2015
- WordPress for Administrators, 2014

Thomas A. Manz

Education – degree, discipline, institution, year

- Ph.D., Chemical Engineering, Purdue University (2009)
- M.S., Chemical Engineering, Purdue University (1998)
- B.S., Chemical Engineering, The University of Toledo (1994)

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- Assistant Professor, Chemical & Materials Engineering, New Mexico State University, Las Cruces, NM, Aug 2012 – present (full time)
- Temporary research scientist (post-doc), Chemical Engineering, Georgia Institute of Technology, Atlanta, GA, Sept 2008 – July 2012 (full time)

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Wal-Mart Stores, photo lab manager, West Lafayette, IN, 2000 – 2002 (full time)
- Photonics, clean room and quality control worker for plasma display manufacturing, Toledo, OH, 1992 – 1993 (part time)

Certifications or professional registrations

- None

Current membership in professional organizations

- American Institute of Chemical Engineers
- Materials Research Society
- American Chemical Society
- American Association for the Advancement of Science
- American Physical Society

Honors and awards

- NSF CAREER Award (2016 – 2021)
- University Research Council, Early Career Faculty Award, NMSU, 2016

Service activities (within and outside of the institution)

- University Research Council member, NMSU (2017 – present)
- Reviewer for computational chemistry and catalysis journals, proposals, and conference presentations

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- N. Gabaldon Limas and T. A. Manz, "Introducing DDEC6 atomic population analysis: part 4. Efficient parallel computation of net atomic charges, atomic spin moments, bond orders, and more," RSC Advances, 8 (2018) 2678-2707.
- T. A. Manz, "Introducing DDEC6 atomic population analysis: part 3. Comprehensive method to compute bond orders," RSC Advances, 7 (2017) 45552-45581.

- Yang and T. A. Manz, "Computationally designed tandem direct selective oxidation using molecular oxygen as oxidant without coreductant,"*RSC Advances*, 6 (2016) 88189-88215.
- Gabaldon Limas and T. A. Manz, "Introducing DDEC6 atomic population analysis: part 2. Computed results for a wide range of periodic and nonperiodic materials,"*RSC Advances*, 6 (2016) 45727-45747.
- A. Manz and N. Gabaldon Limas, "Introducing DDEC6 atomic population analysis: part 1. Charge partitioning theory and methodology," *RSC Advances*, 6 (2016) 47771-47801.
- Yang and T. A. Manz, "Computationally Designed Zirconium Organometallic Catalyst for Direct Epoxidation of Alkenes without Allylic H Atoms: Aromatic Linkage Eliminates Formation of Inert Octahedral Complexes,"*Theoretical Chemistry Accounts*, 135 (2016) 21:1-19.
- P. Lee, N. Gabaldon Limas, D. J. Cole, M. C. Payne, C.-K. Skylaris, and T. A. Manz, "Expanding the Scope of Density Derived Electrostatic and Chemical Charge Partitioning to Thousands of Atoms," *Journal of Chemical Theory and Computation*, 10(2014) 5377-5390.
- Erucar, T. A. Manz, and S. Keskin, "Effects of Electrostatic Interactions on Gas Adsorption and Permeability of MOF Membranes," *Molecular Simulations*, 40(2014) 557-570.
-

Briefly list the most recent professional development activities

- ASEE Summer School for Chemical Engineering Faculty, North Carolina State University, Raleigh, North Carolina, July 29 to August 3, 2017
- Teaching with the Stars, NMSU Teaching Academy, 04/05/2017
- Establishing and Maintaining the 'Write' Habit, NMSU Teaching Academy, 06/22/2017
- Teaching is Acting (Parts 1 & 2), NMSU Teaching Academy, 02/17/2017 & 3/10/2017
- Critical Pedagogy as a Teaching Approach, NMSU Teaching Academy, 03/09/2016
- Unintended Consequences: Formative Assessment as a Tool for Student Learning, NMSU Teaching Academy, 03/08/2016
- WordPress for Administrators, NMSU Teaching Academy, 05/14/2014
- Publish & Flourish, NMSU Teaching Academy, 04/04/2013
- Team Mentoring for Faculty, NMSU Teaching Academy, 12/03/2012

Martha C. Mitchell

Education – degree, discipline, institution, year

- Ph.D., Chemical Engineering, University of Minnesota-Minneapolis (1996)
- B.S., Chemical Engineering, University of Wisconsin-Madison (1989)

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- Professor, Department of Chemical and Materials Engineering; New Mexico State University, Las Cruces, NM. Fall 2007 – present (full-time)
- Diversity Director, NSF Engineering Research Center for Bio-Mediated and Bio-Inspired Geotechnics, August 1, 2015-Dec. 31, 2016 (part-time)
- Associate Dean for Research, College of Engineering; New Mexico State University, Las Cruces, NM February 2012 – August 2015 (full-time)
- Academic Department Head, Department of Chemical Engineering; New Mexico State University, Las Cruces, NM May 2005 – January 2012 (full-time)
- Interim Academic Department Head, Department of Chemical Engineering; New Mexico State University, Las Cruces, NM August 2004 – April 2005 (full-time)
- Associate Professor, Department of Chemical Engineering; New Mexico State University, Las Cruces, NM. Fall 2002 – Fall 2007 (full-time)
- Assistant Professor, Department of Chemical Engineering; New Mexico State University, Las Cruces, NM. Fall 1996 – Fall 2002 (full-time)
- Lecturer, Department of Chemical Engineering and Materials Science; University of Minnesota-Minneapolis, Minneapolis, MN, 1/95—3/96 (part-time)

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Visiting Summer Faculty, Sandia National Laboratories, Albuquerque, NM. Summer 2001 (full-time)
- Visiting Professional, Exxon Research and Engineering, Annandale, NJ. Summer 1997 (part-time)

Certifications or professional registrations

- Professional Engineer, NM#15571

Current membership in professional organizations

- American Association of University Women
- American Institute of Chemical Engineers
- American Society for Engineering Education
- Society of Women Engineers

Honors and awards

- Outstanding Mentor Award, New Mexico State University Teaching Academy
- Robert Davis Professorship

Service activities (within and outside of the institution)

- National Science Foundation, Division of Industrial Innovation and Partnerships (IIP) Committee of Visitors (2013 and 2016)
- Engineering Research Council Board of Directors, American Society of Engineering Educators (2014-2015)
- National Society of Professional Engineers, Professional Engineers in Higher Education Interest Group Executive Board, Southwestern Region Representative, (2012-2015)
- New Mexico Society of Professional Engineers Board of Directors, Education Director (2012-2015)
- American Institute of Chemical Engineers Education and Accreditation Committee (2015-present)
- Chair, Advancing Leaders Committee, NMSU Teaching Academy (2014-present)
- Compliance Committee, NMSU, (2014-2015)
- National Alliance for Broader Impacts (NABI) summit planning committee member (2015)
- Intellectual Property Advisory Committee, NMSU (2012-present)
- New Mexico Consortium Board member (2012-2016)
- Council of Deans of Research (CADRe), NMSU (2012-2016)
- Building the Vision Strategic Planning Committee, NMSU (2012-2013)
- National Academy of Sciences workshop participant, "Key Challenges in the Implementation of Convergence," 2013.
- Advisor for the NMSU local section of the Society for Women in Engineering. 2010-present

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Flores, L. Y., Navarro, R. L., Lee, H. S., Addae, D. A., Gonzalez, R., Luna, L. L., Jacquez, R., Cooper, S., & Mitchell, M., "Academic satisfaction among Latino/a and White men and women engineering students," (2014) Journal of Counseling Psychology , 61(1), doi: 10.1037/a0034577.
- Mitchell, M.C. (2015) "Funding Opportunities from Federal Agencies," American Society for Engineering Education Annual Meeting, Seattle, WA, June 14-17.
- Mitchell, M.C., and Jacquez, R. (2015) "New Mexico State University Broadening Participation Activities," National Alliance for Broader Impacts Summit, Madison, WI, May 30-June 1.

Briefly list the most recent professional development activities

- Just Teaching, Scholarly Teaching and Education Research. Where do you want to be, and how do you get there? (2017)
- Department Heads as Advocates for Women, LGBT Faculty and Faculty of Color at NMSU (2016)
- How Learning Works: Translating learning research to teaching practice (2016)
- The Flipped Classroom: Successful Practices and Common Pitfalls (2016)
- Reflections from the Student Success Navigators: What Faculty and Administrators Need to Know (2016)
- Using Adobe Connect in Canvas (2016)
- The Quiz Tool in Canvas (2016)

David A. Rockstraw

Education – degree, discipline, institution, year

- Ph.D., Chemical Engineering, Oklahoma University (1989)
- B.S., Chemical Engineering, Purdue University (1986)

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- Robert Davis Distinguished Professor, Sept 2013 – Present
- Academic Department Head Chemical & Materials Engineering, July 2012 – Present
- Distinguished Achievement Professor Chemical & Materials Engineering, Aug 2012 – Present
- Professor, Chemical & Materials Engineering, Aug 2004 – Aug 2012
- Associate Professor, Chemical Engineering, May 1998 – Aug 2004
- Assistant Professor, Chemical Engineering, Aug 1995 – May 1998

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- E. .I. DuPont de Nemours Co., Inc. / Conoco, Inc., Ponca City, OK; Research Engineer – Corporate Process Development, full time Aug 1990 – July 1995
- Ethyl Corporation, Orangeburg, SC; Sr. R&D Engineer, Research & Development, full time Sept 1989 – July 1990
- Kraft, Inc., Glenview, IL; Engineer I, R & D Division, full time May 1986 – Aug 1986

Certifications or professional registrations

- Professional Engineer, NM license 14253

Current membership in professional organizations

- American Institute of Chemical Engineers

Honors and awards

- Frank Bromilow Award for Teaching Excellence, 2016
- NMSU Roush Teaching Award, 2014
- NMSU Environmental Health & Safety "Friend of Safety" Award, 2014
- Robert Davis Distinguished Professorship, 2013
- NMSU Distinguished Achievement Professor Award, 2012
- Ed and Harold Foreman Engineering Education Excellence Award, 2012
- National Society of Professional Engineers, Professional Engineers in Higher Education
- Engineering Education Excellence Award, 2009
- E-Council Outstanding Engineering Professor Award, 2008
- AspenTech® Educational Innovation Award, 2004
- Outstanding Faculty Member, voted by the 2001 CH E graduating class
- Research Grand Prize, American Academy Environmental Engineers, 1998
- Level II DuPont Safety Sentinel Award, 1995.
- DuPont Partnering Recognition for Suva® HFC development: 1992, 1991

Service activities (within and outside of the institution)

- American Institute of Chemical Engineers' Fellows Council, 2016-present
- Biomedical Engineering Society,• Faculty advisor, 2014-2015
- Mesilla Valley Preservation, Inc. (mvpres.org)
  - Board of Directors, 2010 – present
  - Treasurer; 2010 – 2013
- Town of Mesilla, Planning, Zoning, & Historical Appropriateness Commission; 2009 – 2011 •
- Las Cruces Inline Hockey Association; Founder and Director; 2000 – 2007

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Corrected rate law for sulfite oxidation mechanism with ethanol-inhibition, D. A. Rockstraw, *Industrial & Engineering Chemistry Research*, **51**(35), p. 11587 (2012).
- Panel: What You Need to Know about Being an Expert Witness (invited panelist), Chemical Engineering & the Law Forum, American Institute of Chemical Engineers National Meeting, November 14, 2016, San Francisco, CA.
- Generating Perchlorate and N-Nitrosodimethylamine Isotherms Using Pecan Shell Activated Carbons; J. Freeh, J. Rodriguez, D. A. Rockstraw, C. E. Brewer, American Institute of Chemical Engineers National Meeting, Salt Lake City, UT, November, 11, 2015.
- Remediating Salt Attack in Adobe and Earthen Structures; E. Liefeld, D. A. Rockstraw, G. Henry, Earth USA 2015 Conference, Santa Fe, NM Oct. 2-4, 2015.

Briefly list the most recent professional development activities

- Improve Your Students' Learning by Teaching Them Effective Learning Strategies, NMSU Teaching Academy, 10/18/2016
- Active Learning: what is it, how do you implement it and why would you want to? NMSU Teaching Academy, 08/29/2016
- Department Head Summer Forum: Leading During Budget Cuts and Organizational Change, NMSU Teaching Academy, 07/26/2016
- WordPress: Using GravityForms, NMSU Training Central, 06/16/2014
- Managing Narcissists, Blamers, Drama Queens and more…, NMSU Teaching Academy, 03/13/2014
- WordPress for Administrators, NMSU Training Central, 02/04/2014
- Flipping the Classroom with Just-in-Time Teaching, NMSU Teaching Academy, 01/31/2014
- ADVANCE Advancing Leaders Program – Cohort Member, NMSU Teaching Academy, 2013

Meng Zhou

Education – degree, discipline, institution, year

- Ph.D., Chemical Engineering, New Mexico State University (2016)
- MS ., Physics, Tulane University (2006)
- BS., Material Chemistry, University of Science and Technology of China (1994)

Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 2002-2007), full time or part time

- Assistant Professor & Lab Manager, Department of Chemical and Materials Engineering, NMSU, 2017 – present, full time
- Research staff, Los Alamos National laboratory, 2009 – 2011, full time

Non-academic experience – company or entity, title, brief description of position, when (ex. 2008-2012), full time or part time

- Lab Manager, Department of Chemical and Materials Engineering, NMSU, 2011 – present, full time\
- Engineer, Carbon Nanotube Technology Inc., Los Alamos 2006 – 2008

Certifications or professional registrations

- None

Current membership in professional organizations

- None

Honors and awards

- Synergy Staff Leadership Award, College of Engineering, NMSU, 2017
- Honorable graduate student, NMSU, 2016

Service activities (within and outside of the institution)

- Editor of Scientific Journal "Chemical Engineering"
- Journal Peer Reveiwer for J. of Materials Chemistry A, Materials Science and Engineering B, J. of Power Source, International J. of Environmental Pollution

Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- M. Zhou, J. Gomez, B. Li, Y.-B. Jiang, S. Deng, Oil tea shell derived porous carbon with an extremely large specific surface area and modification with MnO2 for high-performance supercapacitor electrodes, Appl. Mater. Today, 7, 47-54 (2017).
- M. Zhou, J. Catanach, J. Gomez, S. Richins, S. Deng, Effects of nanoporous carbon derived from microalgae and its CoO composite on capacitance, ACS Appl. Mater. Interfaces, 9(5), 4362-4373 (2017).
- M. Zhou, Y. Li, Il. Jeon, Q. Yi, X. Zhu, X. Tang, H. Wang, L. Fei, S. Deng, Y. Sun, Y. Matsuo, H. M. Luo, G. Zou, Magnetoresistance in self-assembled epitaxial composite La0.67Ca0.33MnO3:NiO and La0.67Ca0.33MnO3:Co3O4films via polymer-assisted deposition, Scientific Reports 6, 26390 (2016).

- M. Zhou, L. Fei, S. Deng, G. Zou, H. M. Luo, Superconducting nitride films prepared by polymer-assisted deposition, Science Advances Today, (Invited Featured Article), 1, 25222 (2015).
- G. Chen, M. Zhou, J. Catanach, T. Liaw, L. Fei, S. Deng, H. M. Luo, Solvothermal route based in situ carbonization to Fe3O4@C as anode materials for lithium ion battery, Nano Energy 8, 126 (2014).

Briefly list the most recent professional development activities

- The Online Course Improvement Program (OCIP): Quality Matters, NMSU Teaching Academy (2017)

Engineering Physics Program
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APPENDIX C. EQUIPMENT

Appendix C – Equipment

Please list the major pieces of equipment used by the program in support of instruction.

This is a summary of major pieces of equipment used in support of instruction based in the Department of Physics. The participating departments in the College of Engineering offer major pieces of equipment in support of engineering course and/or teaching labs for each of the four EP concentrations. Those pieces of equipment are listed in the respective Self-Study Reports for NMSU's Aerospace, Chemical, Electrical and Mechanical Engineering programs. Since the Department of Physics has no control or ownership over equipment in other departments, those pieces of equipment are not listed here.

The Department of Physics has the following pieces of major equipment:

Computer lab – We have 19 computer workstations in our computer lab, most with the Linux operating system, but several with the Windows operating system. These are used in support of the PHYS 150 and PHYS 476 computational physics courses. Students in the physics and EP programs can have accounts on these computers for use in other projects. Keycard access is provided to students in the program around the clock. In addition, wireless is available throughout Gardiner Hall as well as most the NMSU campus.

Optical spectroscopy – There are several different optical spectrometers in use in the advanced instructional laboratories, which can observe photons in the UV, visible, and IR frequency ranges. In addition, there is a large collection of optical sources (H, He, Na, Hg, etc.) for both calibration and measurement. One research lab also has two spectroscopic ellipsometers, one operating from 190 to 2500 nm, the other from 2 to 40 µm. These research set-ups are also used in some of the Advanced Labs and/or Physics Electives.

Franck-Hertz Experiment – There are two working Franck-Hertz Hg tubes, with associated control and measurement equipment.

Rutherford Scattering – We have a small vacuum chamber with an Am alpha-source, gold foils and a silicon surface-barrier detector; equipment for biasing the detector and reading out the charge pulses; and a multi-channel analyzer for recording the pulses.

Millikan Oil Drop Experiment – We have two setups for measuring the electron charge using oil droplets between large capacitor plates, with associated control and measurement equipment.

Geiger-Muller counters – We have a large collection of GM tubes for performing simple experiments in statistics, radioactive decay, and absorption of photons in matter.

Hall Effect – We have an apparatus for observing the Hall Effect in a metal and in both p- and n-type semiconductors; the observations can be done as a function of temperature, magnetic field strength, and current.

Speed of Light – We have two different set-ups to measure the speed of light: a) a version of the "Foucault spinning mirror" apparatus for measuring the speed of light, and an optical table on which to set it up, and b) a pulsed laser, an optical detector, and a set of mirrors that can be arranged on an optical table to perform a measurement of the speed of light *via* a time-of-flight technique.

Photoelectric Effect – We have two setups for measuring Planck's constant *via* observation of the stopping voltage of electrons emitted from a metal, as a function of wavelength of the incident photons.

Electron Diffraction – We have two tubes containing a few kV electron accelerator, graphite target, and electron viewing screen, in which the atomic spacing in graphite is measured via electron diffraction.

X-ray Diffraction – We have a simple X-ray diffractometer for the PHYS 315L lab, which can be used to demonstrate the Bragg effect, with very low resolution. We also have an advanced high-power high-resolution and powder diffractometer (PANalytical Empyrean with CuK_α source and line detector). These research set-ups are also used in some of the Advanced Labs and/or Physics Electives.

Coherent Imaging Set-Up – We have a HeNe coherent optical spectroscopy and imaging set-up, which can be used for determining sub-micron structural features in a variety of materials, including liquid crystals and insect wings. This research set-ups are also used in some of the Advanced Labs and/or Physics Electives.

Zeeman Effect – We have a magnet and Cadmium tube arranged so that the Zeeman splitting may be observed, both transversely and longitudinally with respect to the field direction.

Nuclear Magnetic Resonance – We have a setup with a magnet, source holder, and oscillator circuit, whereby the NMR line-shape may be recorded.

Nuclear Spectroscopy – We have a variety of NaI(Tl) crystals, and a high-resolution high-purity germanium crystal, suitable for observing gamma-rays emitted from radioactive sources, and the associated electronics.

Radiation Detection and Counting Statistics – Geiger counters used to study Poisson statistics with a low-level radiation source ^{40}K.

Muon Lifetime – We have a tank of liquid scintillator for observing the arrival and decay of a cosmic-ray muon, associated scintillator paddles for observing the incoming muon, and associated electronics for operating the detectors and recording the signals.

Compton Scattering – We have a suitable radioactive source, active target, and recoil photon detector for observing the scattering of photons from electrons.

Neutron Source – We have a strong Pu-Be source which produces few-MeV neutrons which can be used for material activation. This is housed in a special access-controlled room in the basement.

Gamma-Gamma Angular Correlation – We have an angular-correlation measurement table, with two NaI(Tl) detectors and associated electronics, which can be used to observe the gamma-gamma angular-correlation in the radioactive decay of ^{60}Co and ^{22}Na.

Alpha spectroscopy - We have a Si surface barrier detector with some vacuum chamber and associated electronics, which can be used to detect alpha particles from an ^{241}Am source. It serves to study the properties of the n-type Si crystal used in the alpha detector.

Rapid Thermal Mini-Annealer – This ULVAC instrument can heat small pieces of solids to very high temperatures (exceeding the melting point of silicon) in nitrogen or oxygen atmosphere. It is used to produce thermal oxide films on a Si substrate, a common processing step during manufacture of modern CMOS devices.

Cryostats – Two ultra-high vacuum cryostats are available for cooling and heating of samples during optical spectroscopy measurements. Using liquid helium or nitrogen, temperatures as low as 10 K (with helium) or 80 K (with nitrogen) can be achieved. These cryostats are also used in some of the Advanced Labs and/or Physics Electives.

Fume Hoods and Wet Lab – Two fume hoods are available in our departmental wet lab for chemical processing of materials. Solvents, acids, and bases as well as other chemicals are stored in appropriate cabinets. Samples can be cleaned in an ultrasonic cleaner or using ozone produced by a mercury lamp.

Introductory Laboratory Equipment – We have numerous sets of lab equipment that are used to teach the introductory level physics laboratories (Phys 213L, 214L and 217L). These include equipment for undergraduate mechanics, electricity, magnetism, optics, and thermodynamics experiments. We pride ourselves on having hands-on laboratories for these classes rather than paper or on-line laboratories. A recent addition to this equipment are a classroom set of oscilloscopes and six setups for projectile motion. The computers, flat-panel displays, and PASCO interfaces were recently updated for these laboratories.

Physics Demonstration Equipment – We have numerous pieces of demonstration equipment ranging from simple balls to tesla coils and Van de Graff generators. Live demonstrations are an important part of our undergraduate teaching.

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APPENDIX D. INSTITUNIONAL SUMMARY

Appendix D – Institutional Summary

Programs are requested to provide the following information.

The Institution

a. Name and address of the institution

New Mexico State University
Las Cruces, NM 88003-8001
575-646-0111
www.nmsu.edu

b. Name and title of the chief executive officer of the institution

Dr. Garrey Carruthers, Chancellor and President, New Mexico State University*

*: Dr. Carruthers retires on July 1, 2018. The position of Chancellor and President was split, and Dr. Dan E. Arvizu has been appointed as the new Chancellor and Dr. John Floros was appointed as the new President.

c. Name and title of the person submitting the self-study report

Self-Study reports are authored by the respective departments and submitted through the ABET portal by Sonya Cooper, Associate Dean of Academics, *College of Engineering*.

d. Name the organizations by which the institution is now accredited and the dates of the initial and most recent accreditation evaluations.

New Mexico State University (NMSU) has been accredited by the *Commission on Higher Education of the North Central Association (NCA) of Colleges and Schools* since 1926, except for a brief period in 1940- 1941. Since 1963, the institution has held preliminary to full accreditation status at the doctoral level. At our last general visit was November 2017. On February 20, 2018 NMSU received word from the *Higher Learning Commission* (HLC) that the *Institutional Actions Council* of HLC continued the accreditation of NMSU with the next reaffirmation of accreditation in 2027-28. The *Council* accepted the report of the HLC review team that visited NMSU in November and concluded in a 111-page document that NMSU met every criterion for accreditation with no concerns.

The *College of Engineering* is accredited by:

- ABET Inc., Engineering Technology Accreditation Commission (date of first accreditation: 1968)
- ABET Inc., Engineering Accreditation Commission (date of first accreditation: 1938)

Type of Control

Description of the type of managerial control of the institution, e.g., private-non-profit,private-other, denominational, state, federal, public-other, etc

New Mexico State University is a comprehensive state-funded land-grant institution of higher learning, Overall responsibility for the university resides in an autonomous *Board of Regents* appointed by the *Governor* of the state and confirmed by the *Senate of the State of New Mexico*. The board delegates authority for the internal management of the institution to the *NMSU*

President. The faculty elects a *Faculty Senate*, which has legislative jurisdiction over policies affecting the academic mission of the university.

New Mexico State University is dedicated to teaching, research, and service at the undergraduate and graduate levels. NMSU is a *NASA Space Grant College*, a *Hispanic-Serving Institution* and is home to the only *Honors College* in *New Mexico*. NMSU provides learning opportunities to a diverse population of students and community members at five campuses, cooperative extension offices located in each of New Mexico's 33 counties, 13 *Research and Science Centers* and through distance education.

Educational Unit

Describe the educational unit in which the program is located including the administrative chain of responsibility from the individual responsible for the program to the chief executive officer of the institution. Include names and titles. An organization chart may be included.

The NMSU *College of Engineering* and the *University Organizational Charts* are provided in Figures D.1 and D,2.

Engineering Physics (EP) is one of the engineering programs in NMSU's *College of Engineering*, but it is run by the *Department of Physics*, which is part of NMSU's *College of Arts & Sciences*. Aside from the *Bachelor of Sciences in Engineering Physics* (BS-EP), the *Department of Physics* offers graduate (M.S. and Ph.D.) and undergraduate (B.S. and B.A.) degrees in Physics under the administrative control of NMSU's *Graduate School* or the *College of Arts & Sciences*, respectively. Since the BS-EP is an undergraduate engineering degree, it is fully administered by NMSU's *College of Engineering*. The *College of Engineering* oversees the departments and programs listed below, and its *Organizational Chart* of the college is provided in Figure D.1. The *Organizational Chart* of the entire institution in provided in Figure D.2.

Chemical and Materials Engineering Department
Department Head: Dr. David Rockstraw

Civil Engineering Department
Department Head: Dr. David Jauregui

Electrical and Computer Engineering Department
Department Head: Dr. Steve Stochaj (Interim)

Engineering Physics Program, Physics Department
Department Head: Dr. Heinz Nakotte (Interim)

Industrial Engineering Department
Department Head: Dr. Hansuk Sohn (Interim)

Mechanical and Aerospace Engineering Department
Department Head: Dr. Ruey Chen

Figure D.1. *College of Engineering Organizational Chart*

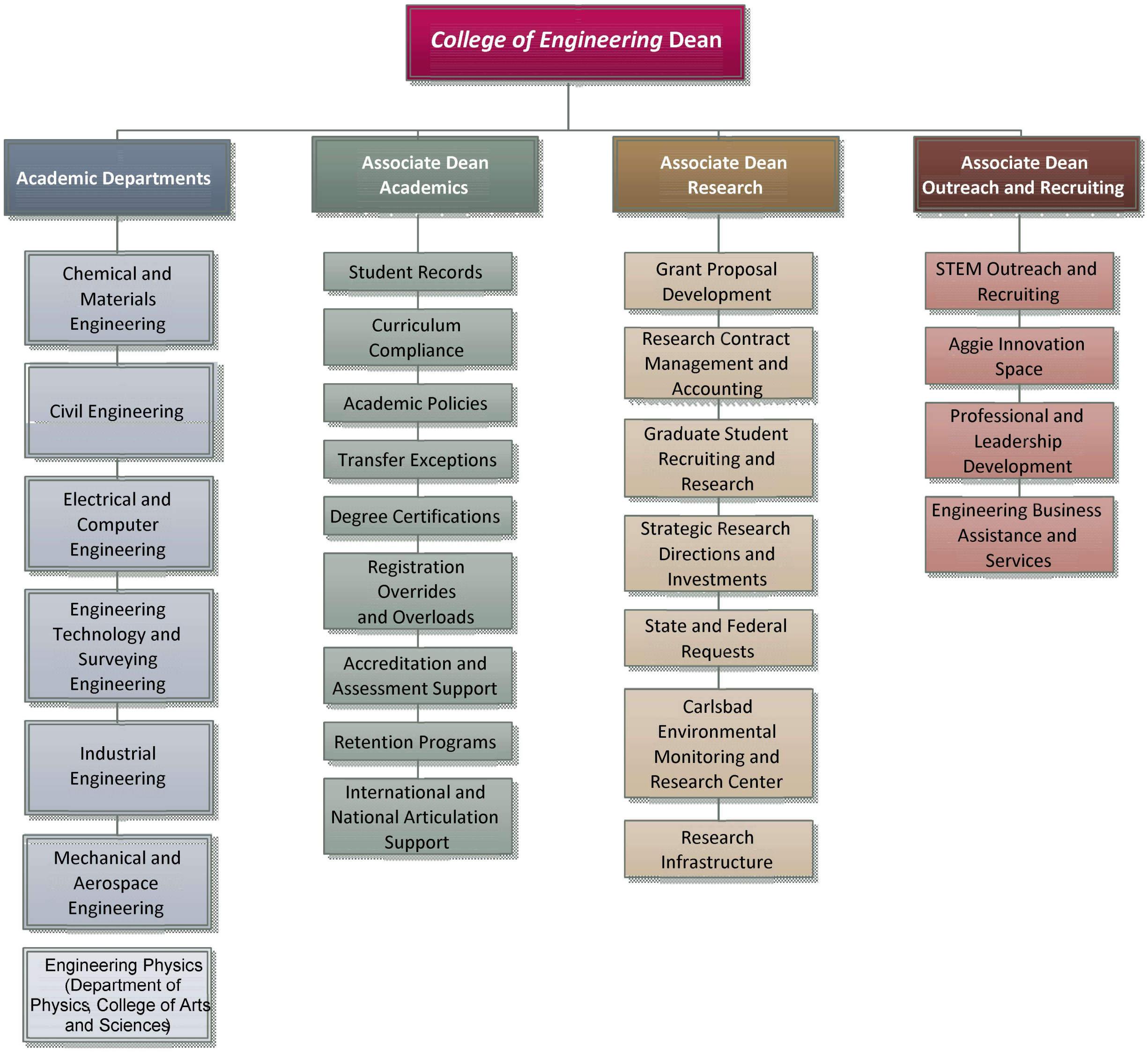
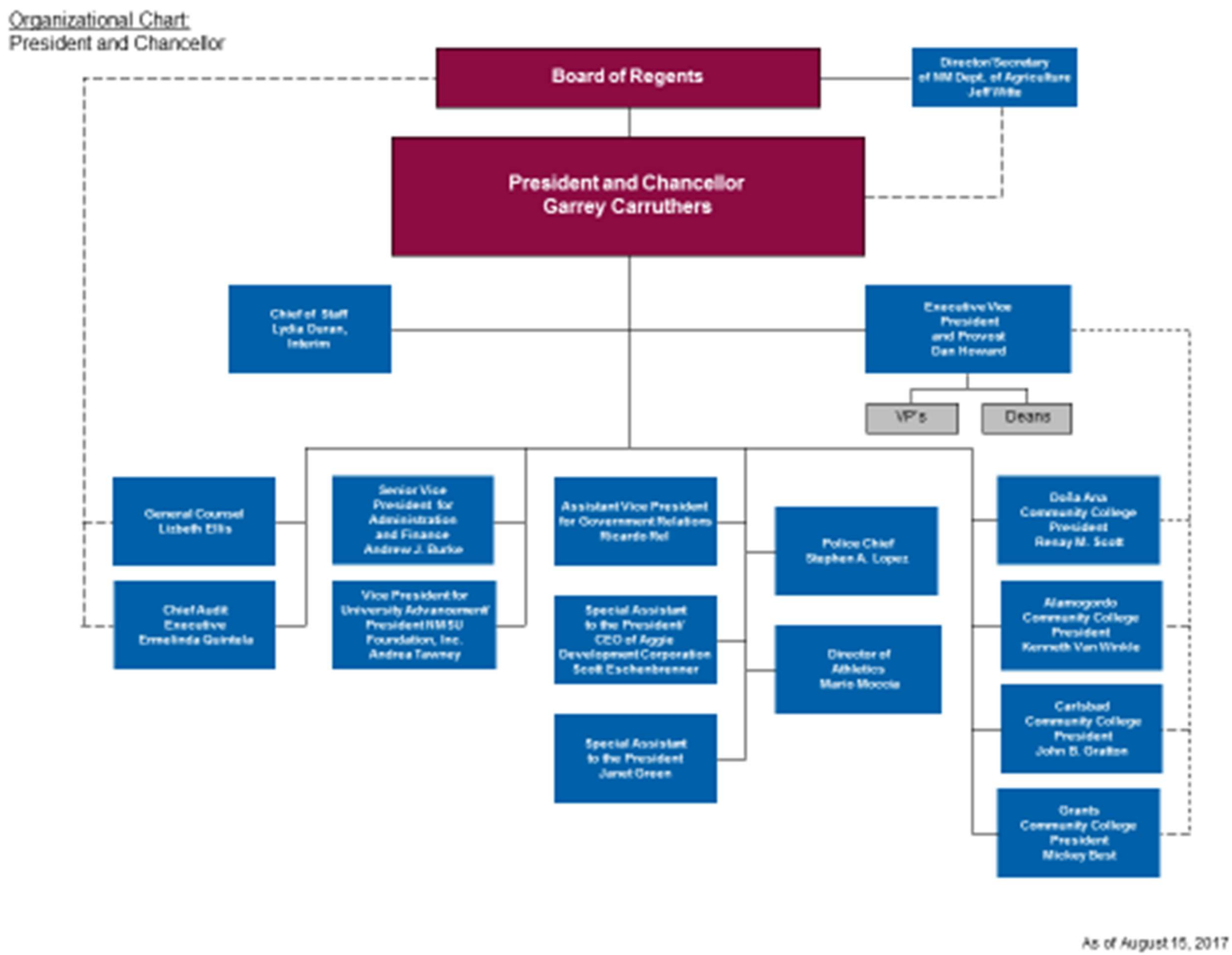


Figure D.2. *University Organization Chart*



Academic Support Units

List the names and titles of the individuals responsible for each of the units that teach courses required by the program being evaluated, e.g., mathematics, physics, etc.

Department of Mathematics
Dr. Joseph Lakey, Academic Department Head
Email: jlakey@nmsu.edu
Phone: (575) 646-3901

Department of Physics
Dr. Heinz Nakotte, Interim Academic Department Head
Email: hnakotte@nmsu.edu
Phone: (575) 646-3831

Department of Chemistry and Biochemistry
Dr. William Quintana, Academic Department Head
Email: wquintan@nmsu.edu
Phone: (575) 646-5877

Department of English
Dr. Lauren Rosenberg, Interim Academic Department Head
Email: laurenr@nmsu.edu
Phone: (575) 646-3931

Department of Communication Studies
Dr. Ken Hacker, Academic Department Head
Email: comstudy@nmsu.edu
Phone: (575) 646-4937

Non-academic Support Units

List the names and titles of the individuals responsible for each of the units that provide non-academic support to the program being evaluated, e.g., library, computing facilities, placement, tutoring, etc.

NMSU Library
Dr. Elizabeth A. Titus, Dean
Email: etitus@nmsu.edu
Phone: (575) 646-1508

Information and Communication Technology
Dr. Norma Grijalva, Chief Information Officer
Email: norma@nmsu.edu
Phone: (575) 646-2026

Student Engagement
Tony Marin, Asst. VP Student Affairs
Email: amarin@nmsu.edu
Phone: (575) 646-7207

Engineering Learning Communities
Elizabeth Howard
Email: ehoward@nmsu.edu
Phone: (575) 646-5894

Credit Unit

It is assumed that one semester or quarter credit normally represents one class hour or three laboratory hours per week. One academic year normally represents at least 28 weeks of classes, exclusive of final examinations. If other standards are used for this program, the differences should be indicated.

New Mexico State University and the *College of Engineering* use the semester hour as the basic unit of academic credit. A credit hour is defined as 750 minutes of lecture (including exams) or 2,250 minutes of laboratory time. Over the course of a 15-week semester, that translates into 50 lecture minutes per week per credit hour. Laboratories meet for 2½ hours per week per credit hour. A typical four credit class consists of one 2½ hour laboratory and either three 50 or two 75-minute lectures. The last week of each semester is dedicated to final exams, with each course typically meeting once for a single 150-minute test. One academic year, consisting of two semesters, provides 28 weeks of instruction, exclusive of final examinations.

Tables

Complete the following tables for the program undergoing evaluation.

Report data for the program being evaluated.

1. Data on this table should be for the fall term immediately preceding the visit. Updated tables for the fall term when the ABET team is visiting are to be prepared and presented to the team when they arrive.; 2. Persons holding joint administrative/faculty positions or other combined assignments should be allocated to each category according to the fraction of the appointment assigned to that category; 3. For faculty members, 1 FTE equals what your institution defines as a full-time load; 4. For student teaching assistants, 1 FTE equals 20 hours per week of work (or service). For undergraduate and graduate students, 1 FTE equals 15 semester credit-hours (or 24 quarter credit-hours) per term of institutional course work, meaning all courses — science, humanities and social sciences, etc.; 5. Specify any other category considered appropriate, or leave blank

Table D.1.a. Engineering Physics Enrollment

Semester		Undergraduate					Graduate Total
		Freshman	Sophomore	Junior	Senior	Total	
Fall 2013	FT	3	7	10	19	**39**	.
	PT	.	.	2	.	**2**	.
Fall 2014	FT	6	4	7	23	**40**	.
	PT	.	.	.	1	**1**	.
Fall 2015	FT	12	10	6	17	**45**	.
	PT	.	.	.	5	**5**	.
Fall 2016	FT	9	11	6	15	**41**	.
	PT	.	.	.	2	**2**	.
Fall 2017	FT	7	5	9	12	**33**	.
	PT	.	2	.	5	**7**	.

Table D.1.b. Engineering Physics Degrees Awarded

Academic Year	Degree Level				Total
	Associate	Bachelor	Master	Doctorate	
2012-13	.	5	.	.	**5**
2013-14	.	4	.	.	**4**
2014-15	.	9	.	.	**9**
2015-16	.	7	.	.	**7**
2016-17	.	6	.	.	**6**

Table D.2. *Personnel for Engineering Physics*

Year[1]: Fall 2017	**Head Count**		**FTE[2]**
	FT	**PT**	
Administrative[2]		1	0.5
Faculty (tenure-track)[3]	13		13
Other Faculty (excluding student assistants)		2	1
Student Teaching Assistants[4]	12	4	14
Technicians/Specialists	1	1	.5
Office/Clerical Employees	1	2	2
Others[5]	4		4

Notes: Administrative: Department Head with 50% teaching load; Graduate teaching and research assistants work 20 hours per week; Specialist: 1 FTE lab coordinator/instructor (MS in Physics); Specialist: 0.5 FTE (graduate student) for IT support (20 hours per week); Others: Research faculty, postdocs, technicians not paid by departmental I&G fun

Letter of Compliance

Engineering Physics Program

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APPENDIX E. SUPPLEMEBTARY DOCUMENTS

Post-Course Instructor Comment Form

Course: ________

☐ lecture course × instructional laboratory ☐ other, specify ___________________

Semester: ___________________

Instructor: ___________________

Estimated average class attendance (in %, after drop date): _____

Final Grade Distribution:

A	B	C	D	F	withdrawn	incomplete	**average grade**
___	___	___	___	___	___	___	_____

A. Grade Basis (check all that apply)

☐ **tests and exams**

How many? _____

☐ take-home ☐ in class

☐ **homework**

How many assignments? ______

☐ written ☐ on-line, using ___________________

☐ from textbook ☐ other sources ☐ own problems

☐ **quizzes**

How many? ______

☐ announced ☐ unannounced

☐ written ☐ oral

☐ course material ☐ related material

☐ other, specify: ______________________________

☐ **projects/reports/essays**

How many (per student)? ______

☐ written ☐ oral

☐ individual ☐ group, how many group members? ____

☐ **class participation/attendance**

☐ attendance list

☐ in-class participation; how measured? ____

☐ other, specify: ____

☐ **other**, specify: ____

B. Textbook

Textbook used: ____

Considering the educational goals of this course, the textbook provides a _____*(fill in)*_______ foundation of the material to be taught.

☐ complete and comprehensive ☐ solid ☐ adequate ☐ marginal ☐ poor

- For future courses, the use of this textbook is:

□ recommended □ recommend with reservations □ not recommended.

- List main deficiencies of the textbook (if any):

____

____

____

C. Teaching Strategies (check all that apply)

Lecture sequence:

□ followed textbook □ followed textbook, but provided supplementary material

□ used my own sequence □ did not use the book, because ______________________

Lecture Style:

□ chalk board □ power point □ overhead slides

□ other (e.g. movies), specify: ____

In-class learning tools:

□ in-class demonstrations □ instant feedback tools

How often? ________________ □ clickers □ flash cards □ other, specify: ____________

Involving students? yes / no

□ group work, specify:____

Hand-Outs:

□ lecture notes □ supplementary material □ homework solutions □ test/exam solutions

□ other, specify: ____

D. Program outcomes

Pre- (and Post-) Test(s)

There are two agreed ways to measure the learning progress of EP students: a) a single pre-test designed to test the student's knowledge of the pre-requisite course or b) a pre- and posttest to determine the students knowledge before and after instruction.

Test	**Measuring Tool** (FCI, standardized test, etc.)	**Target**[a] (in %)	**Result** (in %)	**Number of Students Exceeding Target** (in %)
Pretest				
Posttest (if applicable)				

[a]: The target is given by: □ national average □ department avg. over last __ years plus 5%
□ other, specify: ______________________________

Measuring specific ABET program outcomes

The ABET-style course syllabus dictates that each course is required to independently measure one or several of the EP program outcomes (a-k). The final course grade is not an acceptable measure, thus you need to specify what has been used as an independent measure. In case you measured other ABET outcomes as well, feel free to include them as well, but mark them with an asterisk (*).

Program Outcomes	**Measuring Tool** (GRE, skill-building homeworks, etc.)	**Target**[a] (in %)	**Result** (in %)	**Number of Students Exceeding Target** (in %)

[a]: The target is given by: □ national average □ department avg. over last __ years plus 5%
□ other, specify: ____

E. Instructor's comments

Summarize the ***main deficiencies*** that you have identified:

1. ____
2. ____
3. ____

F. Instructor's suggestions for future course

List some possible improvements, necessary changes, suggestions and useful teaching strategies for the course in future:

1. ____
2. ____
3. ____

G. Course improvements

List changes made in response to past instructor suggestions:

1. ____
2. ____
3. ____

Senior-Student Exit Interview Form

Engineering Physics
Senior Exit Interview

Student Name: Interviewer:

1. Which Engineering Physics option?		
2. Which would you rather do upon graduation?	A. Full-Time Employment	B. Full-Time Graduate School

A. If **Full-time Employment:**

3. How many interviews did you schedule through Placement and Career for full-time employment?					
4. How many on-site interviews for full-time employment did you go on?					
5. How many job offers for full-time employment did you receive?					
6. For the offer that you think you will accept please tell us:					
a. Company Name:					
b. Location:					
c. Job title:					
d. Starting Salary Range (e.g., $40,000-$45,000)					
e. Level of Enthusiasm for this job. (5 = highest)	1	2	3	4	5

B. If **Full-Time Graduate School:**

7. From how many graduate programs did you obtain information?					
8. To how many graduate programs did you apply?					
9. To how many graduate programs were you accepted?					
10. For the graduate program that you think you will attend, please tell us:					
a. School Name:					
b. Location:					
c. Program:					
d. Amount of Initial Support					
e. Level of enthusiasm for this program. (5 = highest)	1	2	3	4	5
11. How many credit hours did you earn as an NMSU student?					
12. What's your GPA?					
13. How many campus-sponsored career fairs did you attend?					
14. How many co-ops or summer internships did you go on?					

15. Rank on a on a scale of 1 to 4 how well your education at NMSU and/or in the Engineering Physics Program prepared you in each of the following areas
1 =agree, 2=neutral, 3=disagree, 4=not important.

a. Scientific expertise – knowledge of concepts and notation	1	2	3	4
1. Mechanics	1	2	3	4
2. Electricity and Magnetism	1	2	3	4
3. Modern Physics	1	2	3	4
b. Experimental training	1	2	3	4
1. Physics experimental training	1	2	3	4
2. Engineering experimental training	1	2	3	4
3. Electronics training	1	2	3	4
4. Mechanical training	1	2	3	4
c. Design abilities	1	2	3	4
1. Project design	1	2	3	4
2. Project implementation	1	2	3	4
3. Project completion	1	2	3	4
d. Teamwork	1	2	3	4
1. Ability to work within a team	1	2	3	4
2. Ability to lead a team	1	2	3	4
e. Problem solving in Physics and Engineering	1	2	3	4
1. Problem solving in Physics	1	2	3	4
2. Problem solving in Engineering	1	2	3	4
f. Professional responsibilities and ethics	1	2	3	4
g. Communications skills	1	2	3	4
1. Oral communication skills	1	2	3	4
2. Written communication skills	1	2	3	4
h. Societal impact – broader impact of engineering on society	1	2	3	4
i. Lifelong learning	1	2	3	4
1. Preparation for the workplace	1	2	3	4
2. Career development skills	1	2	3	4
3. Ability to learn new skills	1	2	3	4
j. Contemporary knowledge	1	2	3	4
1. up-to-date knowledge of physics	1	2	3	4
2. up-to-date knowledge of engineering	1	2	3	4
k. Technical skills	1	2	3	4
1. Computing skills	1	2	3	4
2. Math skills	1	2	3	4
3. Electronics skills	1	2	3	4
4. Mechanical skills	1	2	3	4
5. Statistics and probability skills	1	2	3	4

Concerning the duration of your stay at New Mexico State University, please answer, where: 1=poor, 2=neutral, 3=great, and 4=not important or doesn't apply:

16. Rate the quality of academic advisement that you received	1	2	3	4
17. Rate the quality of career advisement that you received.	1	2	3	4
18. Did the core classes prepare you for the electives (breadth, depth), and capstone classes?	1	2	3	4
19. Rate the facilities:				
a. Physics Department Computing Facilities:				
1. Hardware	1	2	3	4
2. Software	1	2	3	4
b. Physics Department Laboratory Facilities	1	2	3	4
c. Engineering Facilities	1	2	3	4
c. Chemistry Facilities:	1	2	3	4
d. Classrooms	1	2	3	4

16. In your opinion, what are the top three courses in the EP Program that you took?

a.
b.
c.

17. In your opinion, what are the three weakest courses in the Engineering Physics Program?

a.
b.
c.

17. What motivated you to come to NMSU?

18. What motivated you to major in Engineering Physics?

20. Did you transfer into NMSU?	YES	
	NO	

21. What Math did you start with?	

22. Please provide any additional suggestions for improving the educational experience for future EP students.

23. Are you a member of any professional physics, engineering, or science societies?

For the purposes of keeping contact with you after graduation and sending you our Physics Department Newslettter, we would like information about how to reach you in the future. This information will be kept confidential and will be detached from the survey.

Name	
Graduating Year and Semester	
Address after Graduation	
Phone after Graduation	
Email after Graduation	

Alumni Survey Form

Engineering Physics Alumni Survey

Name

Address

Phone

E-mail

Year of Graduation in Engineering Physics

EP Concentration

Your participation in this survey is voluntary. Answer only those questions you are comfortable with.

1. Are you presently employed?

Yes No

If no, are you presently looking for employment?

If not employed, skip to question 9.

Yes No

If yes, full time or part time?

Full time Part time

2. What is the title of your position?

What is your current salary at this position?

3. Who is your present employer?

4. How long have you worked for your present employer?

5. In your present job, how many individuals do you supervise?

6. How long did it take to find your first position after graduation from NMSU?

Had a position lined up before graduating.

1 month

2-3 months

4-5 months

6 months or longer

7. In your present job, do you participate on any teams, or on any multidisciplinary projects?

Yes No

If yes, what disciplines are represented on these projects or teams?

8. Briefly describe the primary responsibilities of your current job?

9. Did you pursue graduate studies after graduating from NMSU?

Yes No Plan to pursue.

10. How many positions (total of employers and positions with each employer) have you held since graduating from NMSU EP.

Please specify all of your job titles and employers.

11. Thinking about courses you've taken, which course at NMSU was the most useful for your career?

12. Still thinking about courses you've taken, which course at NMSU was the least useful for your career?

13. Which activities, programs or courses (not offered when you attended NMSU) would have better prepared you for the workforce and your career?

14. What are the most significant factors for success in your career?

15. Did the NMSU Engineering Physics Program achieve its Educational Objectives? Please rate the following objectives.

Competitiveness

Graduates are competitive in internationally-recognizes academic and industrial environments.

Strongly agree Agree No opinion

Disagree Strongly disagree

Adaptability

Graduates exhibit success in solving complex technical problems in disciplines subject to quality engineering processes.

Strongly agree Agree No opinion

Disagree Strongly disagree

Teamwork and Leadership

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

Strongly agree Agree No opinion

Disagree Strongly disagree

16. I am satisfied with my overall learning experience and preparation from NMSU.

Strongly agree Agree No opinion

Disagree Strongly disagree

17. What professional associations are you a member of?

18. Please list any engineering licenses or certifications that you have received.

Please provide an approximate number of scientific papers, technical reports, manuals or similar that you have published since graduating from NMSU.

Please provide an approximate number of patents that you filed since graduating from NMSU.

Have you received any awards or distinctions since graduating from NMSU? Please list.

Approximately how many continuing education courses, workshops, seminars or other life-long learning activities have you taken since graduating from NMSU?

19. How would you rank your professional preparation in comparison with graduates from other institutions?

Much better Slightly better About equal Slightly worse

Much worse

20. What suggestions do you have for the Engineering Physics program to better prepare students for the workplace?

21. Please provide us with the name and contact info (e-mail address preferred) of your current (or a former) supervisor. We might contact them for an independent employer survey of our EP program.

Thank you for taking the time to answer these questions. Your valued input will help the College of Engineering and the Engineering Physics program better shape and implement a productive curriculum for current and future students.

Be sure to stay in touch and Go Aggies!

Example STAR audit [redacted]

BS - Engineering Physics - Mechanical Option

Prepared	06/09/2018	Program	BS-EP/ME	Catalog	2018
Student	[redacted]	Graduation		Job	

Audit

AT LEAST ONE REQUIREMENT HAS NOT BEEN SATISFIED

******* NEW MEXICO STATE UNIVERSITY STAR REPORT ********

This student academic requirements (STAR) report is a planning tool and is not a contract between the student and the university. This report has been designed to assist you with planning courses to complete degree requirements. Every effort has been made to insure its accuracy; however, final confirmation of degree requirements is subject to department, college and university approval. Students must apply for degrees within deadline dates for the semester in which they anticipate to graduate. If you have questions about your degree audit, please contact your academic advisor.

✓ **Minimum Grade Point Average and Credit Hour Requirements Your Bachelor's degree requires a minimum of 129 completed degree hours, a minimum GPA of 2.00 in all course work, and completing at least 30 of the last 36 hours at NMSU.**

✓ **Cumulative grade point average** — 3.760 GPA

x **Total degree hours earned. (excludes developmental courses)**

- x 121.0 CREDITS — IN-P---> 15.0 CREDITS

✓ **Upper-division courses: Student must complete a minimum of 48 hours at or above the 300-level.**

- ✓ 50.0 CREDITS — IN-P---> 15.0 CREDITS
- ✓ **Residency requirement: At least 30 of the last 36 degree credits must be completed at NMSU.** — satisfied
- ✓ **English Basic Skills Requirement** — satisfied
- ✓ **Mathematics Basic Skills Requirement** — satisfied

✓ **General Education Common Core Area I (9-10 Credits) Communications**

- ✓ Complete three credits of English composition - Level 1 with a grade of C or better

  14FA ENGL111G 3.0 CR RHETORIC & COMPOSITION I

- ✓ Complete three credits of English composition - Level 1 with a grade of C or better

  EXCEPTION: Allow ENGL112

  15SP ENGL112 3.0 A COMP & RHET II

- ✓ Complete three credits of oral communication

  15FA COMM265G 3.0 A PRNCPLS-HUMAN CMNCTN

✓ **General Education Common Core Area II (3 Credits) Mathematics**

- ✓ Complete 3/4 credits of college level Mathematics or higher

  15FA MATH191G 4.0 B+ CALCULUS I

✓ **General Education Common Core Area III (8 Credits) Laboratory Sciences**

EXCEPTION: Allow PHYS213; EXCEPTION; Allow PHYS213L

16SP	CHEM111G	4.0	A	GENERAL CHEMISTRY I
15FA	PHYS213	3.0	A	MECHANICS

15FA	PHYS213L	1.0	A	EXPERIMENTAL MECHANICS

✓ General Education Common Core Areas IV & V (15 credits) Social/Behavioral Sciences and Humanities/Fine Arts

✓ Social/Behavioral Sciences

14SP	PSY 201G	3.0	CR	INTRDN-PSYCHOLOGY
15SP	GOVT110G	3.0	CR	INTRDN-POLITICAL SCI

✓ Humanities and Fine Arts.

15FA	HIST102G	3.0	A	MODERN EUROPE
16SP	PHIL100G	3.0	A	PHILOSOPHY, LAW AND ETHICS

✓ Social/Behavioral Sciences/Humanities/Fine Arts.

13FA	SOC 101G	3.0	CR	INTRDRY SOCIOLOGY

✓ Viewing a Wider World Requirement

Take six credits at the 300 or 400 level in General Education courses. One of the two courses must be in a college other than your own and outside the major department. *See catalog for list of acceptable courses.

18SP	HON421	3.0	A	SPECIAL TOPICS >> MATCHED AS EDUC317V

X EP Core Requirements – Courses in this requirement may also meet Common Core requirements. See your advisor.

✓ **Complete ENGL 111 and 218.**

EXCEPTION: Allow ENGL112

14FA	ENGL111G	3.0	CR	RHETORIC & COMPOSITION I
15SP	ENGL112	3.0	A	COMP & RHET II

✓ **Mathematics Requirement (14 credits) – Complete MATH 191, 192, 291 and 392**

15FA	MATH191G	4.0	B+	CALCULUS I
16SP	MATH192GH	4.0	B+	CALCULUS II HONORS
16FA	MATH291G	3.0	B	CALCULUS III
17SP	MATH392G	3.0	A	INTRO ORD DIFF EQS

✓ **Natural Sciences Requirement (4 credits) – Complete CHEM 111**

16SP	CHEM111G	4.0	A	GENERAL CHEMISTRY I

X **Physics Course Requirement (36 credits)**

15FA	PHYS213	3.0	A	MECHANICS
15FA	PHYS213L	1.0	A	EXPERIMENTAL MECHANICS
16SP	PHYS214	3.0	A-	ELECTRICITY/MAGNETISM
16SP	PHYS214L	1.0	A+	ELECTRICITY/MAGNETISM LAB
16FA	PHYS217	3.0	A	HEAT, LIGHT, AND SOUND
16FA	PHYS217L	1.0	A+	EXP HEAT, LIGHT, AND SOUND
17SP	PHYS315	3.0	A+	MODERN PHYSICS
17SP	PHYS315L	3.0	A	EXPMTL MODERN PHYS
17FA	PHYS395	3.0	A	INTERMEDIATE MATH METHODS
18SP	PHYS454	3.0	IP	INTERM MOD PHYSICS I
18SP	PHYS461	3.0	IP	INTERM ELCT/MAG I

SELECT FROM: PHYS455,462

✓ **Complete PHYS 451 or ME 333.**

17FA	PHYS451	3.0	A	INTRMED MECHANICS I

✓ **Complete 3 additional upper division credits in electives in PHYS and ME.**

18SP	PHYS489	3.0	A	INTRO TO MODRN MATERIALS

x **Mechanical Engineering Requirement (42 credits)**

EXCEPTION: Allow CE233 for ME236

15FA	ENGR100	3.0	A	INTRO TO ENGINEERING
16SP	ME240	3.0	B	THERMODYNAMICS
16FA	ME159	2.0	A+	GRPHCL CMNCTN/DESIGN
16FA	CE233	3.0	A	MECHANICS-STATICS
16FA	ME261	3.0	B+	M E PROBLEM SOLVING
17SP	CE301	3.0	A	MECHANICS-MATERIALS
17SP	ME237	3.0	A	ENGR MECHANICS II
17FA	ME326	3.0	A	MECHANICAL DESIGN
17FA	ME338	3.0	A	FLUID MECHANICS
18SP	ME341	3.0	B-	HEAT TRANSFER
18SP	ME425	3.0	A	DSGN-MACHINE ELEMENTS
18FA	ME345	3.0	IP	EXPRMNTAL METHODS I
18FA	ME426	3.0	IP	DESIGN PROJECT LAB I

SELECT FROM: ME427

Courses in Excess of Specific Requirements

17FA	CHME470	3.0	A+	INTRO TO NUCLEAR ENERGY
18SP	CHME471	3.0	B	HEALTH PHYSICS
18SP	ENGR398	1.0	A+	ENGR LEADERSHIP
17FA	GOVT110G	3.0	A+	AMER NATIONAL GOVT
18FA	GOVT330	3.0	IP	INTRO TO PUBLIC ADMIN
17SP	GOVT366	3.0	A	AMERICAN FOREIGN POLICY
18SP	GOVT391	3.0	A	CONSTITUTIONAL LAW
17SP	PHYS380	1.0	A	INDEPENDENT STUDY

Degree Audit Codes: CR: credit from another institution or advanced placement; IP: in progress

END OF ANALYSIS

Example Faculty Outcomes Summary

Outcomes Assessment Report for Program Outcome (d)
"an ability to function on multidisciplinary teams"

prepared by Boris Kiefer

Summer 2018

Outcome name and description: (d) An ability to function on multidisciplinary teams.

Courses measuring the outcome: PHYS217L, PHYS 315L, PHYS 471, and PHYS 475.

Measurement: Each team performed a peer participation evaluation.

Numerical results and benchmarks of the measurements:

Course	Instructor	Target	Result	Fractional Differential	Measure
PHYS 315L (SP2013)	Pate	4.0	4.0	0	Team participation
PHYS 315L (SP2014)	Pate	4.0	5.0	+25%	Team participation
PHYS 315L (SP2015)	Pate	4.0	3.6	-10%	Team participation
PHYS 315L (SP 2016)	Pate	4.0	3.7	-8%	Team participation
PHYS 315L (SP 2017)	Pate	4.0	3.5	-13%	Team participation
PHYS 315L (SP 2018)	Pate	4.0	3.9	-3%	Team participation
PHYS471 (SP2012)	Zollner and Urquidi	NA	NA	NA	Observation by instructor
PHYS 471 (FA2016)	Zollner	90	100	+11%	Teamwork
PHYS 475L (SP 2015)	Urquidi	90	95	+6%	Group work
PHYS 475L (SP 2016)	Urquidi	75	90	+20%	Group work
PHYS 475L (SP 2017)	Urquidi	75	90	+20%	Group work
PHYS 475L (SP 2018)	Urquidi	75	95	+27%	Group work

Data missing for PHYS217L: FA2013-17: PHYS 475L: SP2013, SP2014.

What curriculum improvements were implemented: loops closed and recommendations.

Recommendations for Curriculum Development:

- PHYS 217L (FA 2013): Keep lecture and lab in sync. Provide a lab final.
- PHYS 217L (FA 2014): Improve experiments such that non-physical results can be avoided, for example in experiment 11, where some students measured negative values for the heat loss.
- PHYS 217L (FA 2016): Shorten grading time used by the TA to provide students with more on-time feedback. Introduce each lab with mini-lecture. Provide a strict policy on report due-dates.
- PHYS 217L (FA 2017): Shorten grading time. Ensure that sufficient experimental set-ups are available in order to avoid large lab groups. Replace outdated and non-functioning equipment. Explain to students what is required in a lab, such as workload and commitment. Provide tutorials to students to learn on how to generate graphs on a computer.
- PHYS 315L (SP2013): Zeeman effect needs a CCD camera; NMR oscillator is faulty, needs repair; speed-of-light motor controller needs repair; Barnes Spectrometer needs to be mounted on a more reliable and reproducible platform; Silicon detector used in Rutherford-scattering lab is very noisy, need new ampmeter for use with this detector. Modify lab manual to emphasize the difference between uncertainties in derived and measured quantities. Upgrade software to Microsoft Office 2010.
- PHYS 315L (SP2014): Zeeman effect needs a CCD camera; control of semiconductor mount needs to be fixed, impossible to observe Hall voltage. Implement MatLab for data analysis. NMR oscillator is faulty, needs repair; speed-of-light motor controller needs repair; Barnes Spectrometer needs to be mounted on a more reliable and reproducible platform; Silicon detector used in Rutherford-scattering lab is very noisy. Continue modifying lab manual to emphasize the difference between uncertainties in derived and measured quantities. Setup and use of logbook to keep track of persistent problem in experimental setups.
- PHYS 315L (SP2015): Barnes spectrometer needs to be mounted. Continue improving lab write-ups.
- PHYS 315L (SP2016): Change sections of the lab manual and replace references to “accuracy” and “precision” with “uncertainty” and derived quantities. Replace Photoelectric Effect experiment since it is impossible to obtain meaningful results.
- PHYS 315L (SP2017): Use logbook to CANVAS and use its GROUPS option that gives each group a dedicated online workspace.
- PHYS 315L (SP2018): CANVAS/GROUP was a success and is now recommended to be default workspace for student online teamwork, file sharing, and messaging.
- PHYS 471L (F2012): Make clear to the students that the course is taught by instructors with different expectations.
- PHYS 471L (F2016): Acquire at least one more instrument and replacements for consumables such as graphite susceptors. Remind students on the use of common styles in presentations and written reports. Rubrics were used to evaluate teamwork.
- PHYS 475L (SP2015): Use a lab manual to orient the students and to provide more structure to the course, rather than hand-outs. Focus on a single experimental technique to

provide students with in-depth experience rather than surveying many different experimental techniques.

- PHYS 475L (SP2016): Instruct students that labs may require more time than the class meeting time. Make workload requirements must be made transparent to students.
- PHYS 475L (SP2017): Address student workload and commitment.
- PHYS 475L (SP2018): Allow students from other (physics) labs to share the same physical workspace as the PHYS 475 students. Distribute "lab-kits" that contain the necessary equipment for the experiment(s).

Implemented recommendations:

- PHYS 217L (FA 2016): Rather than requesting a complete report each week focus on one or two portions of the report (plus measurements and error analysis). Transparency in grading was accomplished by providing the students with rubrics. Provided some templates for students to use excel for visualization. Introduced two new labs, one for polarization and one for statistics and entropy. Rewriting of the lab manual for 9 labs.
- PHYS 217L (FA 2017): Introduced Readiness Assurance Tests (RATs) to improve student preparedness for the labs, many students found this useful. Lab report submission policies were strictly enforced (at most one week late). Added a new experiment on "Properties of Sound", rewrote error analysis and other handouts.
- PHYS 315L (SP2013): Replaced old hardware and upgraded software to Microsoft Office (2010). Modified lab report format to clarify the difference between uncertainties in measured and directly derived data. Tuning and calibration of Jarrell-Ashe spectrometer.
- PHYS 315L (SP2014): Computer upgrade to Microsoft Word 2010 completed.
- PHYS 315L (SP2015): Added 12-megapixel camera to Zeeman experiment. Continued to use instructor logbook for lab improvement and maintenance. Continued development of new and more detailed guidelines for lab reports. Speed-of-light experiment was fixed. NMR was re-introduced as an experiment. MatLab license was purchased and software was installed on the lab computers.
- PHYS 315L (SP2016): Use of instructor logbook to record solutions and problems that were encountered during the labs. Leybold precision voltmeter for Hall effect experiment and the controller for the Franck-Hertz experiment were replaced. Two neon tubes were purchased to expand the Frank-Hertz experiment that was previously solely based on Mg tubes.
- PHYS 315L (SP2017): Started transition to CANVAS GROUP option for student online collaboration, file sharing, and messaging. Improved and retained Photoelectric Effect experiment. TA was a graduate student.
- PHYS 315L (SP2018): Completed transition CANVAS GROUP option for student online collaboration, file sharing, and messaging. TA was a graduate student.
- PHYS471L (F2012): This was the first time the course was taught in a long time and new experiments were used.
- PHYS 471L (F2016): Continuation of lab manual development, added more material and a section of XRD safety training. Introductory lectures on spectroscopy and the use of

latex for report preparation were provided to orient students at the beginning of the course.
- PHYS 475L (SP2017): Made students aware of workload and commitment.
- PHYS 475L (SP2018): Discussed expected workload and commitment with students at the beginning of the semester.

Loops closed:

- PHYS315L: MatLab allows using the same software that is emphasized in engineering courses. Guidelines continue to be developed to assist students in error analysis and statistics.
- PHYS 471L: Teamwork was assessed through rubrics.
- PHYS 475L: Teamwork was assessed through group projects.
- PHYS 217L: outcome (D) was not measured.

Your own assessment of the assessment process for the outcome: Are the tools working, or some better than others? Recommended changes?

- PHYS 217L: It is not clear if and how outcome (d) was measured, hence it is not possible to evaluate the outcome assessment tool.
- PHYS 315L: It remains unclear how the team participation grade is used to guide future improvements of the course. Team participation is variable and it seems that in many cases working in teams is understood as a means to reduce workload in the course. Many experiments have been upgraded/repaired/revised, this will give access to a wider variety of lab experiments and support new opportunities for teamwork. The only measurement available is through team participation so it is impossible to establish a comparison. It is excellent to move student online teamwork to CANVAS, that reduces maintenance of a local file server and every student enrolled in the course has automatic access to this service. Using a graduate TA seems beneficial since he/she can better assist the teams.
- PHYS 471L: It is not clear how outcome (d) was measured in F2016 and hence it is not possible to evaluate the outcome assessment tool.
- PHYS 475L: Insufficient information was provided to evaluate if the tools are working or not. It is an interesting idea to provide a common workspace where students from all undergraduate labs can come together and exchange ideas.

Recommended changes:

- Collect data from a wider range of courses to understand better which assessment tools work.
- PHYS 217L: Provide information on how outcome (d) was assessed.
- PHYS 315L: It may be worthwhile to have students evaluate another team members report. This may enforce for team members to work together more closely and to communicate better.
- PHYS 471L and 475L: Provide details how outcome (d) was assessed and how the numerical values listed in the Post-Course Instructor Comment Form were obtained.

Exhibit Material for ABET visit

Materials available to the ABET team during their site visit

The *Department of Physics* and the *Engineering Physics Program Committee* store all data relevant to the *Engineering Physics Program* electronically on a designated *OneDrive* folder, with exception of examples of student work. The ABET team will have access to all relevant data contained in that folder at the time of their site visit. In addition, the *EP Program* will provide hard copies of materials in four different sets of binders, the contents of which are listed below.

'Maroon' Instructor's Notebooks

At the end of each course, instructors are expected to prepare the following materials and upload them to the relevant course folder on *OneDrive*:

- completed *Post-Course Instructor Comment Form*
- supporting material of how the *Program Outcomes Assessment* was done, if necessary
- the course syllabus and actual schedule followed
- copies of exams, quizzes and homework, or references thereto
- final-grade calculation spreadsheet (with student names removed)
- copies of other class materials that were provided, or references thereto

For the ABET site visit, we will provide physical folders for each (required or elective) physics course in so-called *'Maroon' Instructors Notebooks*. Each *Instructor's Notebook* contains a) a full set of materials the last time the course was taught prior to the site visit and b) copies of the *Post-Course Instructor Comment Forms* every time that course was taught since Fall 2012. The engineering departments use their own *Assessment Processes*, and therefore, we cannot provide similar materials for engineering courses.

'White' Course Notebooks

The *'White' Course Notebooks* are updated only once every six years, and they are intended to show student work in each (physics or engineering) course the last time it was taught prior to the ABET review. None of the student work is stored on *OneDrive*, and the materials provided are only available as hard copies. The ABET team will have access to *'White' Course Notebook* materials for all required and elective *Physics* courses and a few select engineering courses (2 each from *Aerospace*, *Chemical*, *Electrical*, and *Mechanical Engineering*), including examples of *Capstone Design* courses involving EP students. It should be noted that such materials are available for all engineering courses in the respective engineering departments, who will undergo their own ABET evaluation at the same time. The *Course Notebooks* contain the following:

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

'Blue' Outcomes Notebooks

All materials related to *Program Outcomes* are available on the designated *OneDrive* folder. For the ABET site visit, we will prepare 11 separate physical folders, one for each of the *Program*

Outcomes (a)-(k). The *'Blue' Outcomes Notebooks* will contain the following materials collected since Fall 2012:

- individual *Outcomes Summaries* of physics courses provided by faculty
- supporting material of how the *Program Outcomes Assessment* was done in individual physics courses, if provided
- summaries of *Senior Student Exit Interviews (SSEI)* of graduating EP students
- summaries of *ETS-MFT* tests

Outcomes Summaries from engineering are provided in *Criterion 4 – Continuous Improvement* of this Self-Study Report, and additional materials related to Program Outcomes in engineering courses will be available with the associated engineering departments, who will undergo their own ABET evaluation at the same time.

'Black' *Educational Objectives* Notebook

All materials related to Program Educational Objectives are available on the designated *OneDrive* folder. For the ABET site visit, we will prepare a physical *'Black' Educational Objectives Notebook*, which contains the following:

- *Engineering Physics (EP) Program Committee* meeting minutes, since Fall of 2012
- 2014, 2016, 2017 and 2018 *Engineering Physics External Advisory Board (EPEAB) Reports* and meeting minutes
- summaries of 2014 and 2017 *Alumni Surveys*
- other relevant information

The EP Program will also provide copies of textbooks, laboratory manuals and other course materials for all physics and some engineering courses that are taken by EP students as part of their curriculum.