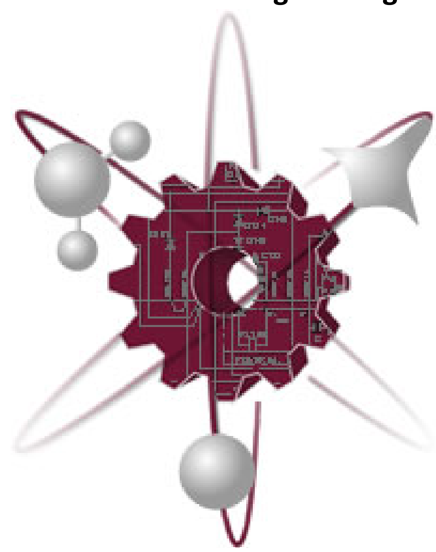
Self-Study Report

Engineering Physics

Bachelor of Science in Engineering Physics



New Mexico State University

Submitted to:
Engineering Accreditation Commission
ABET, Inc.
111 Market Place, Suite 1050
Baltimore, MD 21202-4012

Submitted by:
Engineering Physics Program
Gardiner Hall, 1255 N. Horseshoe Dr.
New Mexico State University
P.O. Box 30001 MSC 3D
Las Cruces, NM 88003-8001

June 2012

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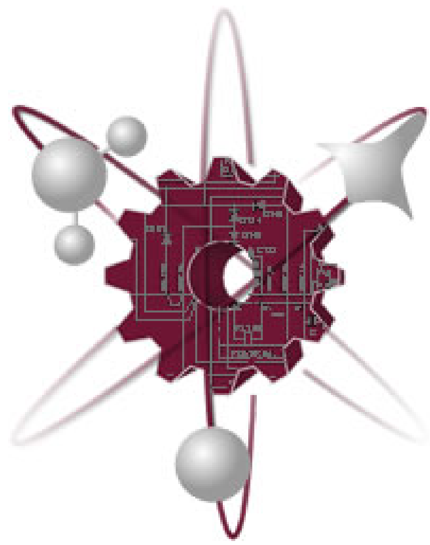

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BACKGROUND INFORMATION

The mission of Engineering Physics program at New Mexico State University is to offer an ABET-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

A. Contact Information

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

The main contact for the Engineering Physics Program is:
Dr. Heinz Nakotte
Chair of the Engineering Physics Program Committee
Department of Physics
New Mexico State University
PO Box 30001, MSC 3D
Las Cruces, New Mexico 88003
Phone: (575) 646-2459
Fax: (575) 646-1934
E-mail: hnakotte@nmsu.edu

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

The primary contact for the College of Engineering is:
Dr. Sonya Cooper, Ph.D., P.E.
Associate Dean of Academics
College of Engineering, MSC 3449
New Mexico State University
P.O. Box 30001
Las Cruces, NM 88003-8001
Phone: (575) 646-2912
Email: socooper@nmsu.edu
Fax: 575-646-3549

B. Program History

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

For more than 40 years, the Department of Physics has offered the traditional physics degrees, i.e. Bachelor's of Science (BS), Masters of Science (MS), and Doctorate of Philosophy (PhD). By the 90s, most of the emphasis had been on the graduate programs, and the BS was designed mostly to prepare students for advanced graduate studies in Physics. However, the Physics faculty members recognized a steadily increasing demand for students with a more applied undergraduate degree, especially for industry and the public school systems. In addition, our BS degree did not adequately prepare students who wished to pursue other disciplines in graduate school. Therefore, in 1998, the Department added a Bachelor's of Arts (BA), designed to retain most of the core physics courses, but requires a minor in another department. Popular minors are Mathematics and Astronomy.

Even with the introduction of a BA degree, it became quickly apparent that this degree did not fully satisfy the needs of new-technology industries. At the same time, most traditional engineering curricula do not provide an in-depth coverage of important concepts in modern physics (quantum mechanics, condensed matter physics, laser optics, atomic physics, and nuclear physics), which play an instrumental role in modern technology. Moreover, many prospective students had expressed concern about the job opportunities with 'just' a BS in Physics. There had been (and still is) a widespread belief that a graduate degree is required for a rewarding career of a physicist.

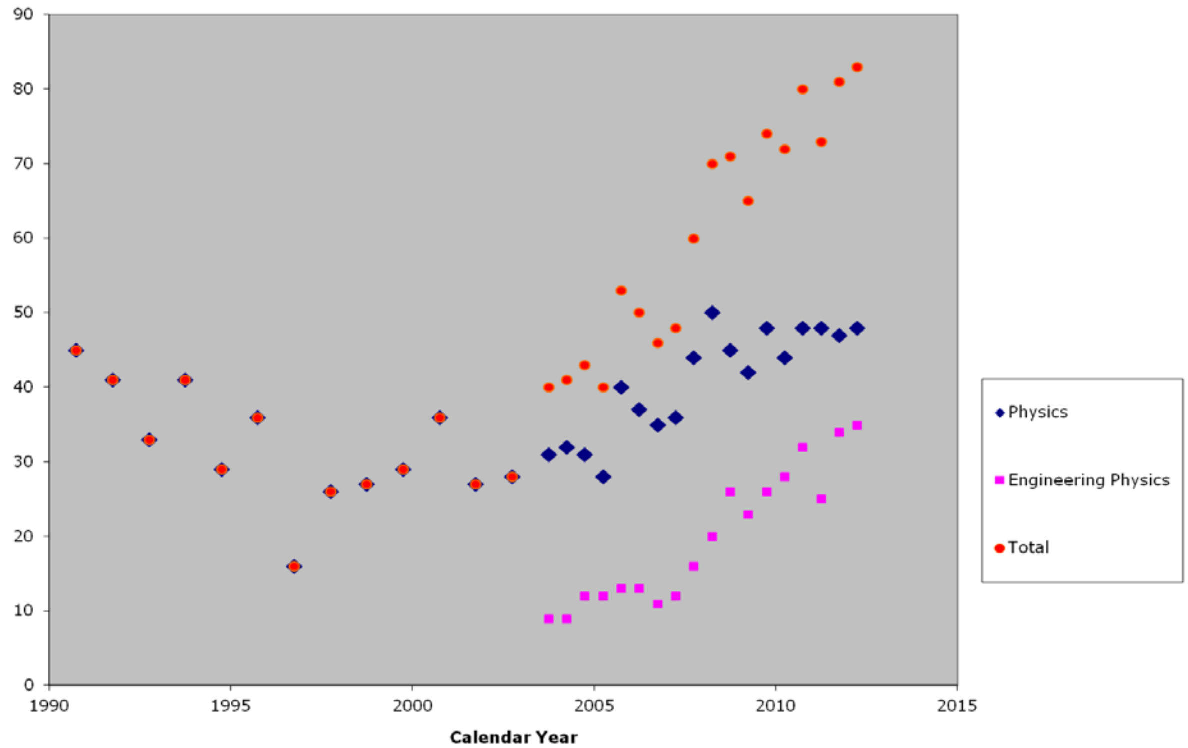
In response, the Department of Physics therefore proposed a Bachelor's of Science in Engineering Physics (EP) degree. The degree was proposed in 2001 and curricula for two emphasis areas (one in *Mechanical Engineering* and one in *Electrical Engineering*) were developed jointly with the respective engineering departments. The Engineering Physics degree was internally approved and placed in NMSU's Undergraduate Catalog for the first time in 2002. In 2004, Engineering Physics celebrated its first graduate. In 2006, the Department of Physics filed for the first accreditation of the Engineering Physic program with ABET, and the program was accredited in 2007.

Following ABET accreditation, Engineering Physics added two additional emphasis areas (one in *Aerospace Engineering* and another in *Chemical Engineering*), in response to needs and demands from program constituents. Since then, the program experienced continuous average growth at a rate of ~4 students per year, as can be seen in Diagram 0.1. In Spring of 2012, the enrollment in Engineering Physics at New Mexico State University totaled 35 students, 17 of which were in the *Mechanical*, 11 in the *Electrical*, 4 in the *Chemical* and 3 in the *Aerospace concentrations.*

Similar to other science and engineering programs, Engineering Physics exhibits 'saw-like' enrollment with higher numbers in the fall semesters (when high-school graduates typically come in) and decreased numbers in the spring semesters. This can be attributed to the fact that incoming high-school graduates often do not have the necessary math and science background needed for a demanding program such as Engineering Physics and switch to less demanding degree programs within the university or drop out completely.

By now, the Engineering Physics enrollment has almost reached the number of physics majors, where the enrollment has become fairly stagnant in recent years. In fact, it can be estimated that in 1-3 years, there will be more Engineering Physics than physics undergrads in the department. Moreover, the Engineering Physics program is almost solely responsible for the growth of the total undergraduate enrollment (combined Physics BS or BA and Engineering Physics BS) in the department.

Diagram 0.1. Enrollment of Physics and Engineering Physics majors since 1990.



In the past 2 years (i.e. since Fall of 2010), 24 'new' students had entered the Engineering Physics program, 17 of which remain in the program. Of those incoming students, slightly more than 50% are high-school graduates registering for the first time in college; others are transfers from junior colleges, other institutions or other majors. The majority of enrolled students leave the program just after or during their freshman year due to inadequate high-school preparation in the STEM disciplines. However, another significant fraction of Engineering Physics students switch majors in their junior year, mostly because they run into troubles with 400-level upper-division physics courses. The Engineering Physics Program Committee has tried to address these retention issues for example by the introduction of a new *PHYS395* course on *Intermediate Mathematical Methods in Physics*. New Mexico State University is located in a fast growing sun-belt city of Las Cruces, near the large multi-cultural metropolitan areas of El Paso, Texas and Ciudad Juarez, Mexico. Tuition remains relatively low and therefore we expect a continuous increase in EP enrollment over the next decade.

Of the presently enrolled Engineering Physics students, 5 were classified as freshman, 8 as sophomores, 9 as juniors and 13 as seniors within the university system. It should be noted, however, that university-level classification strictly depends on credit hours taken 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 actually join the EP program. Since Engineering Physics tends to attract the stronger high-school graduates, a more meaningful classification based on the starting semester yields the following distribution: 8 freshman, 6 sophomores, 10 juniors and 11 seniors. New Mexico State University in an accredited minority-serving institution, and this is reflected also in EP enrollment: Of the 35 EP students (Spring 2012), 14 EP students and 1 EP student are self-declared Hispanic or American Indian, respectively.

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." At NMSU, a minimum of 128 credit hours are currently required for graduation in any field. Engineering Physics consists of a core set of courses in physics, a core set of courses in a particular engineering field, required credits in mathematics and other sciences, state-mandated general-education requirements, *Viewing-the-Wider-World (VWW)* courses as well as some electives.

When originally introduced, Engineering Physics was offered with two 'options': one in *Electrical Engineering* and another in *Mechanical Engineering*. In 2010, the term 'option' was changed to 'concentration' in order to ensure consistency in terminology for specified areas of study across campus. The number of actual credits in each category depends upon the program concentration chosen by the student, which is discussed in detail below. Currently, Engineering Physics students may choose the *Aerospace*, *Chemical*, *Electrical* or *Mechanical concentrations*. Starting with the 2012-2013 Undergraduate Catalog, the requirements for the different concentrations are briefly summarize in the following sections.

The *Aerospace Engineering concentration* of the Engineering Physics program requires a total of 130 credit hours, which consist of 15 credits in the State of New Mexico Common Core areas IV and V, 6 credits in VWW courses, 14 credits in Mathematics, 10 credits in English and Communications, 4 credits in Chemistry, 33 credits in Physics, 42 credits in Mechanical & Aerospace Engineering, 3 credits in Civil Engineering, and 3 credits of Electives (upper-level Physics or Engineering course).

The *Chemical Engineering concentration* of the Engineering Physics program requires a total of 130 credit hours, which consist of 15 credits in the State of New Mexico Common Core areas IV and V, 6 credits in VWW courses, 14 credits in Mathematics, 10 credits in English and Communications, 16 credits in Chemistry, 39 credits in Physics and 30 credits in Chemical Engineering.

The *Electrical Engineering concentration* of the Engineering Physics program requires a total of 130 credit hours, which consist of 15 credits in the State of New Mexico Common Core areas IV and V, 6 credits in VWW courses, 14 credits in Mathematics, 10 credits in English and Communications, 4 credits in Chemistry, 42(36) credits in Physics, 33(39) credits in Electrical Engineering and 3 credits of Electives (upper-level Physics or Electrical Engineering course). Students can opt to take *EE 310* and *EE 351 to* satisfy the *PHYS 461* and *462* requirements.

The *Mechanical Engineering concentration* of the Engineering Physics program requires a total of 129 credit hours, which consist of 15 credits in the State of New Mexico Common Core areas IV and V, 6 credits in VWW courses, 14 credits in Mathematics, 10 credits in English and

Communications, 4 credits in Chemistry, 39(36) credits in Physics and 38(41) credits in Mechanical Engineering and 3 credits in Civil Engineering. Students can opt to opt to take *ME 333* to satisfy the *PHYS 451* requirement.

D. Organizational Structure

Using text and/or organizational charts, describe the administrative structure of the program (from the program to the department, college, and upper administration of your institution, as appropriate).

The Engineering Physics (EP) program at New Mexico State University (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 and Computer Engineering (College of Engineering), Mechanical & Aerospace Engineering (College of Engineering) and Chemical Engineering (College of Engineering).

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

However, the Engineering Physics degree is an engineering degree and therefore administered by NMSU's College of Engineering. The College of Engineering is in charge of all academic issues of the Engineering Physics program, including accreditation, curricular issues, program quality.

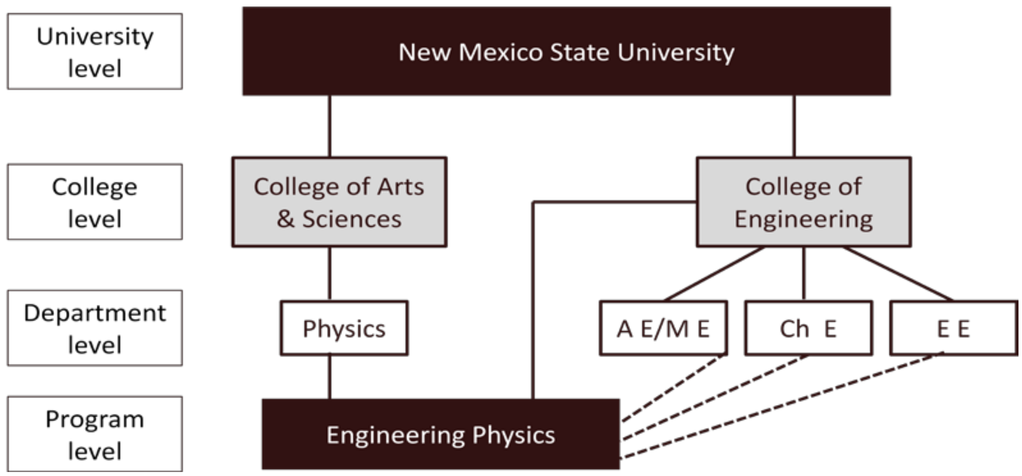
Both colleges benefit from the across-college Engineering Physics degree. The College of Engineering benefits in that the program is fully supported financially through the Department of Physics in the College of Arts & Sciences. The College of Arts & Sciences benefits as the Engineering Physics program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

The Engineering Physics program itself is run by an Engineering Physics Program Committee, which consists of members from the Departments of Physics (College of Arts & Sciences), Mechanical & Aerospace Engineering, Chemical Engineering and Electrical Engineering. The EP Committee is in charge of all program issues, including curricula, program evaluation & growth etc. Current members of the Engineering Physics Program Committee are given in Table 0.1. The organizational chart of the Engineering Physics program is given in Diagram 0.2.

Table 0.1. Members of the Engineering Physics Program Committee – 2012

Dr. Heinz Nakotte (Chair), Faculty, Department of Physics
Dr. Thomas Hearn, Faculty, Department of Physics
Dr. Steve Pate, Faculty, Department of Physics
Dr. Igor Vasiliev, Faculty, Department of Physics
Dr. Mike DeAntonio, Faculty, Department of Physics
Ms. Elena Fernandez, Staff, Department of Physics
Dr. Young Park, Faculty, Mechanical & Aerospace Engineering Department
Dr. Muhammed Dawood, Faculty, Electrical Engineering Department
Dr. Paul Andersen, Faculty, Chemical Engineering Department
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 program at NMSU.



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

Except for the capstone design projects, course and laboratories are typically taught using traditional face-to-face teaching approaches. Capstone design courses often require students to be involved some major design project. In general, the students will work in (often interdisciplinary) teams of 3-5 students, more or less independent of an actual instructor. If approved, participating departments will provide the necessary budget and the space needed to complete a capstone project. In many cases, capstones are done in collaboration with industrial partners, and those might provide some of the needed funding. Occasionally, students design their own capstone project, which are sponsored and supervised by individual faculty members. In all cases, students are expected to give presentations on the progress of a project, to participate in formal design review sessions and to write a final design document.

F. 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.).

In general, 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 Engineering as well as the Department of Aerospace & Mechanical Engineering, *Thomas Brown Hall* and *Goddard Annex* in the case of the Department of Electrical Engineering. Program-specific requirements in Mathematics and Chemistry are typically held in *Science Hall* and the *Chemistry Building*, respectively. General-education and other courses are either held all over campus in buildings housing the respective department offering a particular course or in big lecture halls, such as *Hardmann Hall*.

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.

During the first ABET site visit in Fall 2006, the program reviewer for Engineering Physics had identified two program shortcomings:

1) *The program is well organized and has defined educational objectives. However there is no data on the attainments of graduates who are 3 to 5 years beyond graduation because the first graduate of the program finished in 2004. The program has plans in this area but it remains to be seen if the results of evaluations will be used to develop and improve program outcomes. The program has a "weakness" because the program has not yet demonstrated compliance with criteria 2.*

2) *The capstone design experience involves multi-disciplinary teams from engineering physics, electrical engineering, and mechanical engineering. The engineering physics program is currently making efforts to satisfy this criterion, but this is a relatively new program and there is potential for engineering physics students to not be appropriately included. The program has a "concern" in terms of compliance with criteria 4.*

The former of these short-coming was mostly due to fact that in 2006 our Engineering Physics program was a new program and did not have any graduates 3-5 years beyond graduation at that time. The latter of these stated short-comings triggered more involvement of physics faculty in capstone design projects that are held in the Engineering Departments as well as the offering of some capstone projects in the Department of Physics.

The Engineering Physics Program Committee submitted two interim reports dated 6/1/2008 and 4/30/2009 to ABET in order to address these shortcomings. A final statement from ABET received in June of 2009 indicated that both short-comings have been resolved. Therefore, no previous shortcomings are addressed in this document. Instead, processes for self-evaluation and corrective actions have been implemented; see specifically *Criterion 4 – Continuous Improvement*.

H. Joint Accreditation

Indicate whether the program is jointly accredited or is seeking joint accreditation by more than one commission.

NMSU's Engineering Physics program is neither jointly accredited nor is it seeking joint accreditation with another commission.

Criterion 1: Students

Engineering Physics

Bachelor of Science in Engineering Physics

Self-Study Report

New Mexico State University

June 2012

CRITERION 1. STUDENTS

This chapter describes the procedures for admission, evaluating student performance, dealing with transfer students, student advising and graduation requirements for the Engineering Physics program of the Department of Physics at New Mexico State University.

It should be noted that Engineering Physics is an engineering degree awarded through the College of Engineering, while the Department of Physics is part of the College of Arts & Sciences.

A. Student Admissions

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

As a land-grant institution, New Mexico State University (NMSU) has a fairly lenient admission policy. Admission criteria are listed in the NMSU's Undergraduate Catalog and they are summarized below.

To be accepted into NMSU, an entering freshman should meet the following:

- a high school GPA of at least 2.0 and an ACT standard composite score of at least 20, or
- a high school GPA of at least 2.5, or
- an ACT standard composite score of at least 21

Incoming freshman are also expected to meet the following minimum high-school requirements:

- 4 years of English, two of which must be composition, one at the junior-level,
- 2 years of science beyond general science,
- 3 years of mathematics, taken from: algebra I, algebra II, geometry, trigonometry, or advanced math, and
- 1 year of foreign language or fine arts.

A student who has a single deficiency from the list above will be admitted if the high school GPA is at least 2.25 and the ACT standard composite score is at least 20.

A new student, other than a transfer student, who does not meet the requirements for regular admission may be admitted under the provisional program. To do this, students have a high school GPA of at least 2.25 and an ACT standard composite score of at least 19. Alternatively, they must have met all but one of the minimum high school requirements with a GPA of at least 2.0 with an ACT score of 20 or have an ACT score of 21 or more. Provisional students must take at least 6, but no more than 12, credits per regular semester (3-6 during summers). Those students who earn at least a 2.0 GPA within two semesters are moved to regular admission status, the others are typically denied further attendance. However, those students may appeal to the University's Undergraduate Admission Appeals Committee and/or enroll at a community college until the deficiencies are removed.

Currently, neither the Department of Physics nor the College of Engineering impose any additional program-specific admission requirements onto incoming Engineering Physics students beyond those set by the University. Therefore, admission to the Engineering Physics program is open to any NMSU student. In order to declare a major in Engineering Physics, a student simply declares a major as such with the registration clerk of the College of Engineering. The student's records will be modified to indicate Engineering as the primary college and Engineering Physics as the major. This is the case for both, incoming new students and already admitted students who switch majors.

However, prior to each semester, the College of Engineering places advising holds onto every engineering student (including Engineering Physics). The advising hold prevents students from enrolling in classes at NMSU's main campus until they met with the approved advisor prior to each semester. Individual departments assign advisor(s) to each engineering student or to a particular engineering major. Engineering Physics has currently two faculty advisors, Drs. Heinz Nakotte and Tom Hearn, both from the Department of Physics.

Math Placement

The Engineering Physics curriculum presumes that the students are ready to take *MATH 191* (Calculus I) as beginning freshmen. It is fairly common, however, that incoming high-school graduates do not have the required math skills for the chosen Engineering Physics major. In an effort to advise students into the highest-level math classes for which they are prepared, the Department of Mathematical Sciences enforces a strict guideline to determine initial math enrollment. Students with ACT Math (ACTM) scores below 17 are placed into developmental math classes at one of the community college branches (usually, Doña Ana), such as *CCDM 103N* or *CCDM 114N*.

Students with ACTM scores above 16 must take a Math Placement Exam (MPE) to establish eligibility for higher-level classes. Although the MPE is not mandatory, without it, students are only allowed to enroll in the developmental math classes. The MPE consists of four 10-question sections, which cover material taught in different math classes: (a) Algebra Skills, (b) Intermediate Algebra, (c) College Algebra, and (d) Trigonometry. Correctly answering 60% of the questions in a given section allow the associated class to be skipped. MPE scores are reported as a set of four integers, indicating the number of questions correctly answered in each section. Thus, a score of 10,8,9,4 means the student answered all ten of the questions on (a) Algebra Skills correctly, missed two questions in the (b) Intermediate Algebra section, missed only one question on (c) College Algebra, but only got four correct in (d) Trigonometry. This student would be placed into *MATH 190 (Trigonometry and Pre-Calculus)*. Students are allowed to re-take the MPE once. The rules for math placement are provided in Table 1.1.

The Associate Dean of Engineering for Academics may, under special circumstances, recommend a student be placed in a math course other than the MPE results would indicate. Such placement is rare and must be accepted by the Department of Mathematical Sciences.

English Placement

Entering freshmen with ACT English (ACTE) scores of less than 16 are placed directly into developmental English any of the branch campuses (typically on-line), such as *CCDE 105N* or *CCDE 110N*.

Table 1.1. Initial Math Placement using ACT Math Scores or Math Placement Exam (MPE) at NMSU.

Math Course		Minimum		Prerequisite for Direct Entry
Number	Title	ACTM	MPE	
CCDM 103N	Computational Skills	≤ 15	N/A	*None*
CCDM 114N	Algebra Skills	≥ 16	N/A	*CCDM 103N*
MATH 120	Intermediate Algebra	≥ 16	a ≥ 6	*CCDM 114N*
MATH 121	College Algebra	≥ 16	a+b ≥ 12	*Math 120*
MATH 190	Trigonometry and Pre-Calculus	≥ 16	a+b+c ≥ 19	*Math 121*
MATH 191	Calculus I	≥ 16	≥ 6,6,6,6	*Math 190*

Table 1.2. Initial English Placement at NMSU.

English Course		Minimum ACTE	Prerequisite for Direct Placement
Number	Title		
CCDE 105N	Effective Communication Skills	1-12	*None*
CCDE 110N	General Composition	13-15	*CCDE 105N*
ENGL 111G	Rhetoric and Composition	16-24	*CCDE 110N*
ENGL 111H	Rhetoric and Composition-Honors	25-36	

Advanced Placement

Incoming students who completed college-level courses in secondary school and have taken the Advanced Placement Examination of the College Examination Board with resulting composite scores of 3, 4 or 5 may receive college level credit. Such credit will be treated as transfer credit without a grade ('CR' will be indicated instead), will count toward graduation, and may be used in fulfilling specific curriculum requirements or course prerequisites. NMSU's evaluation criteria for advanced placement and course credit from other institutions can be found at http://prospective.nmsu.edu/general/course-credit-by-exam.html.

Upper Division Admission Requirements

At NMSU, students are not allowed to enroll in upper division coursework (300 or above) until they have demonstrated basic skills in English and mathematics. Students satisfy their basic skills requirements once they have completed *ENGL 111G*, *MATH 180* and *Math 185*.

Transfer students may satisfy the basic skills requirement with prior credit. Those with at least 45 credits are allowed to enroll in upper division courses for one semester. This semester of grace allows the transfer student to demonstrate the basic skills or, more commonly, lets the transfer credit catch-up to the student. After the semester of grace, transfer students must adhere to the same upper-division admission requirements as any other student.

Provisional Admission

A new student (other than a transfer student) who does not meet requirements for regular admission may be admitted under the provisional program. To be admitted to provisional status, students must:

- have a minimum high school grade-point average of 2.25 and ACT composite score of 19 and meet all the minimum high school unit requirements listed above, or
- have met all but one of the minimum high school units listed above, and
    a. have a high school grade point average of at least a 2.50 or
    b. have a high school grade point average of a 2.00 and an ACT standard composite score of 20, or
    c. have an ACT standard composite score of at least 21. Such a student must take at least 6, but not more than 12 credits, in a regular semester, and at least 3, but not more than 6 credits, in a single summer session.

A provisional student earning a 2.0 grade-point average or higher in at least the minimum number of credits as stated above will be granted regular admission. Should the provisional student earn less than a 1.0 grade-point average in the first semester, further attendance will be denied.

A provisional student earning less than a 2.0 grade-point average, but more than a 1.0 grade-point average in at least the minimum number of credits as stated above, in the first semester may continue for one additional semester. However, a provisional student who fails to attain a 2.0 grade-point average during the second semester will be denied further attendance. Students who are denied further attendance may reapply to NMSU after they have completed a minimum of 24 credits with a 2.0 GPA at another regionally accepted institution.

Home School Students

Students enrolled in a home school program may be accepted to NMSU if they meet the requirements for regular or provisional admission as previously stated. In addition, the home school educator must submit a transcript or document that lists the courses completed and grades earned by the student, and the transcript must also indicates the date the student completed or graduated from the home school program. Home school students who are New Mexico residents and wish to participate in the Lottery Success Scholarship program are required to submit official New Mexico GED test results.

Admission by GED

Any student who has successfully completed the GED may apply for admission. Students are encouraged to submit an official high school transcript of the work they completed in addition to their GED scores. The admission will depend upon satisfactory scores on the General Educational Development (GED) test and the American College Testing Program (ACT) test, and a review of minimum high school unit requirements.

Admission of International Students

New Mexico State University is located in Las Cruces close to the Mexican border, and it is not uncommon to have international students (mostly of Mexican nationality) to apply for admission in the various degree programs.

The admission process for international students is described in NMSU's Undergraduate Catalog. Most importantly, students must prove their English language proficiency with standardized tests. For example, NMSU requires a score of 500 or higher for the paper-base and 61 or higher for the internet-based TOEFL test. Prospective international students must have completed a minimum of 12 years of school and submit an official diploma or completion certificate. International students seeking NMSU credit for advanced high-school courses (similar to AP courses in the US) may petition the Physics Department Head for such. Typically, the Department Head will seek advice from a colleague familiar with the educational system in the foreign country, inquire with other department heads (if the course of question is from a different department) and/or interview the student to test his/her knowledge of the subject. The Department Head may also request some written evidence, such a high-school syllabi or textbooks and then make a written recommendation and seek approval by the Dean of Academics. In the case of prospective Engineering Physics students, one approval s are granted, the College of Engineering Advising Center will petition the NMSU Registrar's Office to add the transfer credits to the official NMSU transcript of the student.

In some cases, transfer agreements exist between NMSU and foreign universities, which spell out the equivalency of courses and transfer of foreign credits.

Foreign-course transfer credits may be counted to meet course pre-requisite and/or graduation requirements, but they will not be included in the calculation of the grade-point average (GPA).

Readmission (Degree Seeking)

Former students of NMSU (or of one of its Community Colleges), who have been out of school for more than two consecutive terms, are required to make formal application for readmission. Applications should be submitted to the Office of University Admissions at least 30 days before the opening of the semester or summer session for which the student plans to enroll.

A student who has attended other institutions during an absence must have official transcripts forwarded directly to the Office of University Admissions by the registrar of each institution and must be eligible to return to the college or university last attended. Transcripts must be received prior to the date of registration. Admission status at the time of readmission will normally be determined by previous NMSU academic standing. However, academic performance at other institutions attended during the applicant's absence from NMSU may be taken into consideration in determining the student's admission status.

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.

The Department of Physics implemented a comprehensive process to evaluate the student progress based on measuring student-learning objectives and outcomes. This process and the findings will be described in great detail in Criterion 4 – Continuous Improvement.

Monitoring Student Progress

The Engineering Physics program monitors student progress through yearly ***Student Progress Review*** meetings. We review each student in the program and assign them a grade, A through F, on their progress towards degree. The results of this are used to alert faculty and advisors when students are having difficulty, and also to identify top students that faculty may want to recruit into their research programs. In addition, each class participates in the NMSU evaluation system. This ensures that all physics faculty are teaching the appropriate classes at the appropriate level to optimize student success. Results from the Engineering Physics program Student Progress Reviews and class evaluations can be found in the '*Blue' Program Outcomes Notebook* (called 'blue' because of the color of its binder).

Engineering Physics students are assigned an advisor and required to be advised in person each semester. Advisors review student progress at the advising meeting and advise students on their class selection for the next semester. Advisors utilize flowcharts for each of the concentrations in the Engineering Physics program. Flowcharts are provided in the section on *Criterion 5 - Curriculum*. Each flowchart visually shows the students the pre-requisite and co-requisite requirements for a particular class. The flowcharts are used to guide the student through the degree program and provide them with a list of the courses required as well as what course sequence is recommended.

New Mexico State University supplies an online advising and planning tool called STAR (Student Academic Requirements) to audit student progress. STAR provides up-to-date degree audits to individual students as well as faculty and staff members who have the appropriate on-line access permission. All undergraduate degree programs offered by the Department of Physics (including Engineering Physics) are available on STAR. Audits can be run for any major, minor, or for catalog year. The STAR system is an essential planning tool for both students and their advisors. It is also used to ensure that all graduation requirements have been met at the time of graduation. An example of a STAR audit is provided in *Supplementary Documentation.*

Meeting Pre-requisites

The system used by the University for enrolling students into classes is called Banner. This software has a built-in list to ensure students have met the proper pre-requisite requirements for taking a class. This pre-requisite list is prepared by the department and submitted to the Registrar's Office and is then entered into the degree program database. If a student attempts to register for a class in which he/she has not met the prerequisite requirement, Banner will flag the class and notify the student that they have not met course pre-requisite requirements.

On occasion, waiving a pre-requisite is unavoidable and a student will request a waiver for a pre-requisite. For example, a transfer student may need to have a pre-requisite requirement removed or a student could not take the pre-requisite in a timely fashion because of time conflicts with other classes in the previous semester(s). Students are encouraged to talk to their advisor in order to explore all possible alternative options. If a pre-requisite waiver is indeed necessary, the students (together with the advisor) petition with the instructor to waive pre-requisite requirements for a particular 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 Physics Building (Gardiner Hall) and the department hosts and supports many of their activities. In addition, each society has two faculty advisors, at least one of whom will participate in their meetings (typically every week during the semester). Both societies play an instrumental role in the department's recruitment and retention efforts.

The Department of Physics organizes annual meetings involving all faculty members to discuss the progress of every single undergraduate student enrolled in its different major programs (including Engineering Physics). Students that are 'in trouble' (failing grades, inadequate course enrollments or similar) are contacted individually by their respective advisors in order to discuss how to best approach and correct their individual situation.

The office of Associate Dean for Academics of the College of Engineering informs the Chair of the Engineering Physics Program Committee whenever a previously enrolled Engineering Physics student has transferred to a different program or withdrew from the university. The Chair of the Engineering Physics Program Committee will try to contact those students in an attempt to understand what led to the student's decision to leave the program. Such information is used as additional input for evaluation and assessment of the Engineering Physics program.

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.

Transfer students from other colleges or universities may be accepted for undergraduate studies if they have at least a 2.0 cumulative grade-point average and are eligible to return to the college or university last attended. The regulations for transfer credits are listed in the Undergraduate Catalog, and they are summarized below.

Transfer students who have less than 30 credits have to meet first-time freshman admission requirements.

Transcripts

The transfer student must have official transcripts forwarded directly to the Office of University Admissions by the Registrar of each college or educational institution previously attended. The ACT or SAT may be required of students who have not earned credit for the first semester of college English. A student who conceals the fact that he or she has attended another college or university, and who has not had the Registrar submit a transcript for each institution whether or not credit was earned, will be subject to immediate suspension. Transcripts must be received before the date of registration. Students submitting transcripts from a foreign post-secondary institution are required to have the credentials evaluated by a nationally recognized credentialing service. NMSU requires a "Comprehensive Course by Course Evaluation" be completed for each post-secondary institution attended. Contact the Office of University Admissions for approved credentialing organizations.

Transfer of Credits at NMSU

NMSU evaluates courses from postsecondary institutions that are regionally accredited or are candidates for regional accreditation. Transfer students will receive full credit for coursework completed with a grade of C or better, provided the classes are similar or equivalent to courses offered at NMSU. A transfer student may, on the basis of an evaluation of his or her transcripts, receive credit for courses taken at other institutions in which a grade of D was earned. However, NMSU does not accept the transfer of courses with D grades that satisfy basic academic competency (basic skills) in English and mathematics. NMSU will not accept transfer credit for 4 credit basic skills courses (such as *ENGL 111G* and *CCDM 114 N*) when the incoming course carries less than 3 credit hours. Also, colleges or departments may choose to accept only courses graded C or higher in their programs for both transfer and native students. Any lower-division course from another institution receiving transfer credit from NMSU at the 300 or above level will still count as a lower-division course. Transcripts will be reevaluated when students transfer from one NMSU college to another. Each college determines which transferred courses are applicable toward a degree or a minor. 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.

Community/Junior College Transfers

Community/junior college transfer students may be admitted and classified on the basis of acceptable credits earned at a two-year institution. However, transfer students are subject to the same graduation requirements as other NMSU students, including the required minimum number of credits from courses numbered 300 or above and the requirement that the last 30 credits must be earned through this university.

Evaluation of Transfer Credits

Once a student has been admitted to NMSU, an evaluation of credits on a course-by-course basis is submitted to the college (by the Registrar’s Office) to which the student is admitted. The student’s academic dean approves those transfer courses that are acceptable toward a degree or a minor. Credits from non-accredited institutions may be evaluated by the student’s academic dean after the student has completed two semesters in full-time status with satisfactory grades. Currently enrolled students must obtain prior approval from their academic dean before work taken at another institution may apply toward meeting graduation requirements.

Religious Center Courses in Religion

Courses in religion, offered by the various religious centers through higher educational institutions with which they are affiliated, are open to all students, and these or similar courses from other universities may be transferred for credit to this university. If a student wishes to have earned credits transferred to NMSU, the following procedures must be observed:

- Obtain written approval from the academic dean prior to registration for the course at the religious center
- Count the credit in the course as part of the total semester load
- Following completion of the course, request that the institution granting the credit send a transcript of the credit to the registrar at NMSU

Registration for these courses in religion is separate from NMSU's registration and is conducted by the religious center offering the course. No more than 6 credits in such courses may be transferred to NMSU.

Transferring Courses to Fulfill the New Mexico General Education Common Core

During the *2005 New Mexico Legislative session, Senate Bill 161*, consistent with requirements of state law (Chapter 224 of the Laws of New Mexico, 1995 as amended) was signed into law to further enhance and facilitate the articulation of general education courses among New Mexico's colleges and universities. In accordance with policies established by the New Mexico Higher Education Department, designated general education core courses successfully completed at any regionally accredited public institution of higher education in New Mexico are guaranteed to transfer to any New Mexico public institution. Students enrolling for the first year of study at a New Mexico college or university and considering possible transfer into a certificate and/or degree program at another institution are encouraged to take the courses approved for transfer during their freshman and sophomore year of study.

The core matrix of approved courses guaranteed to transfer and meet general education requirements at any New Mexico college or university can be found on the New Mexico Higher Education Department web site at www.hed.state.nm.us. Courses are listed by institution, whether university or community college, under each of the five general education areas. The courses for New Mexico State University are listed in the required courses section of the Undergraduate catalog.

Transferring Courses Within Degree Programs

To facilitate the transfer of courses within certain degree programs, New Mexico colleges and universities have collaborated to develop transferable discipline modules. These are made up of an agreed upon number of hours and courses. When discipline module courses are taken in addition to the 35 hour general education core, the total number of hours in a transfer module is approximately 64.

For information on the transferable discipline module for Business or Early Childhood Education, see the NMSU Undergraduate catalog. Information on all available statewide transfer modules can be found on the New Mexico Higher Education Department web site at www.hed.state.nm.us.

Student Responsibility

Planning for effective transfer within 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.

Transfer Credit Appeal Process

All New Mexico public post-secondary institutions are required to establish policies and practices for receiving and resolving complaints from students or from other complainants regarding the transfer of coursework from other public institutions in the state. A copy of NMSU's transfer credit policy may be obtained from the Office of the Registrar or from the Deputy Secretary for Academic Affairs, Higher Education Department, 2048 Galisteo Street, Santa Fe, New Mexico 87505-2100.

National Student Exchange (NSE)

Courses transferred back to NMSU by students participating in the National Student Exchange (NSE) Program will be evaluated as NMSU courses and recorded on the student's academic record. All computable grades earned will be included in calculating the student's cumulative grade-point average.

Processing for Completing Exceptions

Exceptions can be submitted to the Academic Dean of the College of Engineering for the following reasons:

- Degree Requirement Substitution (allow a non-standard course to satisfy a requirement)
- Degree Requirement Waiver (allow graduation without satisfying a requirement)
- Pre-Requisite Waiver
- Change Transfer Evaluation (change an existing transfer evaluation)
- Request Foreign Transfer Credit (allow credit for work done abroad)

The College of Engineering implemented a weblink (https://engr.nmsu.edu/cgi-bin/exception-request) for electronic submission of requests for substitutions and/or exceptions for approved personnel. As the Chair of the Engineering Physics Program Committee, Dr. Heinz Nakotte has been granted access.

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).

Advising

Prior to each semester, the College of Engineering places an advising hold on all students' Banner accounts. This prevents the students from registering for classes until they have been advised. Once the students have been advised, the advising hold is removed and the students will be able to register. This database is updated by the department as needed to reflect changes in the course catalog.

Advising begins with required new student registration/orientation (NSR) for freshmen in the summer before the start of their first semester at NMSU. During the orientation, the students will do the following:

- be given an overview of the university and university life,
- take the Math Placement Exam (MPE), and

- meet with the Engineering Physics Advisor to discuss the concentrations of the Engineering Physics program and to place them in the correct classes .

Students often arrive with deficiencies in English and Math. Based on SAT and ACT English scores, students may be required to take remedial English course, 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 plus a Math Placement Exam administered by the Math Department. The Engineering Physics curriculum presumes students begin Calculus (Math 191) during their first semester. Students who are not prepared to start at the Calculus level take preparatory math courses, chemistry, and General Education courses during that transitional period. Those students generally take longer than other students to complete their degrees. Occasionally, the advisors try to meet the challenge of keeping these students interested and involved in the EP program by placing them into 100-level Physics courses.

Once students are enrolled in the Engineering Physics program, the students continue to be advised by the Engineering Physics Advisors throughout their program. All Engineering Physics students are advised in person (at least once) prior to each semester. Typically, the Engineering Physics students will know their advisor and arrange for a meeting just before on-line course registration opens. The Chair of the Engineering Physics Program Committee will send e-mail reminders to students who forget to arrange for a meeting with their advisor. Advising holds will be removed only after the student met with an advisor.

Advising for course enrollment in the upcoming semester entails the following steps:

Step 1.

Collect relevant Registration Materials

(a) a print-out of the student's most current STAR audit transcript
(b) a list of relevant classes and their schedules;
(c) a list of Viewing a Wider World courses;
(d) a list of New Mexico General Education Common Core courses; and
(e) a plan of course schedules up to graduation (flow chart)

Step 2.

Draft a Schedule

(a) 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
(b) choose humanities and social science electives, such that they satisfy both NMSU"s General Education Requirements and the NM General Education Common Core.

Step 3.

Removal of Advising Hold and Class Registration

Once the student has met with his/her advisor, the Advisor will ask the Department of Physics Secretary, Loretta Chavez, to remove the hold. After that, the student is cleared for on-line course registration.

The Engineering Physics Advisors keep folders for each individual Engineering Physics student, and they are encouraged to fill out an Advising Form in order to keep track of any student/advisor interaction. The Advising Form has space for advisor notes, course substitutions, and an area for action items that require immediate attention. An electronic copy of the most current Advising Form can be accessed at http://engineeringphysics.nmsu.edu/forms.html, and a copy is also provided in *Supplementary Information*. After coming in for advising, students will be given a copy of the most recent advising form.

Prospective graduates

Engineering Physics students who plan to complete graduation requirements at the close of the next semester or summer session will make an appointment for a record check with either one of the Engineering Physics Advisors. They will also file an on-line *Degree Application Form* and submit it prior to the posted deadline to the Registrar's Office.

Closed classes

ADD/DROP slips can be used for enrollment in a closed section of a course. Each ADD/DROP slip requires signatures from the Engineering Physics advisor, the instructor of the course, and the department head of the department offering the course.

Career Guidance

Career advising of Engineering Physics 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 a number of activities geared toward career guidance and preparation, such as:

- undergraduate research opportunities at NMSU,
- finding summer internships in academia, national labs and/or industry,
- on-campus visits and colloquia from representatives of industry, national labs or professional societies,
- Physics GRE preparation workshops, and
- CV workshops

These and similar activities allow that students learn about career opportunities and how to 'sell yourself' to potential employers of Engineering Physics graduates. Moreover, several physics faculty members are open to review application or interview material of prospective graduates upon request. Therefore, our Engineering Physics graduates are typically well prepared for on-campus *Career Fairs* and similar events, which are often attended by companies and other entities that tend to recruit Engineering Physics 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.

The university offers a Study Abroad alternative to substitute for one of the Viewing the Wider World (VWW) course requirements. Other than that, the Engineering Physics program does not have a process for awarding credit for work in lieu of courses. However, students who feel that they have already mastered a topic can petition with an instructor to take a challenge exam, and the petition requires approval by the Department Head and the Engineering Physics

Committee. The petition has to outline reasons why the student believes that he/she has already mastered the subject.

In general, offering of challenge exams is discouraged and therefore extremely rare. However, if permission is granted, the challenge exam is designed by the instructor and should reflect the knowledge base a student is expected to have mastered by the end of the particular course. If the student passes the challenge exam the Associate Dean of Engineering for Academics and the Registrar will be notified, and the student will be awarded credit for the class.

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.)

For the baccalaureate degree, students must satisfy three sets of requirements: university-, college-, and program-specific, each of which is described in some more detail below.

University-Specific Requirements

New Mexico State University enforces the following ***minimum requirements*** for each of the approved degree programs:

- completion of 128 credits,
- demonstrated basic skills in English and remedial laboratory work,
- completion of 48 credits in courses numbered at least 300 (upper division),
- a cumulative GPA of 2.000 in all courses taken at NMSU, and
- at least 30 of the last 36 credits must be earned at NMSU.

As part of their 128 credits, students are expected to satisfy course requirements due to state-wide New Mexico Common Core or ***general education requirements***. The New Mexico Common Core is intended to provide all students with a broad foundation and common framework upon which to develop knowledge and skills, social consciousness and respect for self and others. In particular, the New Mexico Common Core ensures that all students receive a broad background in English, social sciences, general sciences, and the arts. An approved list of General Education courses at NMSU (identified by the G suffix) is published in the Undergraduate Catalog. The New Mexico Common Core consists of the 5 different areas:

- Area I: Communications (9-10 credits)
- Area II: Mathematics/Algebra (3 credits)
- Area III: Laboratory Science (8 credits)
- Area IV: Social/Behavioral Sciences (6-9 credits)
- Area V: Humanities and Fine Arts (6-9 credits)

In general, Engineering Physics students will automatically satisfy general education requirements in Areas I-III since courses (such as *ENGL111G, ENGL 218G*, *COMM 265G*, *MATH 191G*, *PHYS 215G & lab* and *PHYS 216 G & lab*) can be taken to satisfy both general education and program-specific requirements.

Moreover, NMSU requires all students to satisfy an equivalent of 6 credits for ***Viewing the Wider World (VWW)* courses**. In most cases, students will take two separate 3-credit VWW courses to satisfy this requirement. An approved list of VWW courses (identified by the V suffix) is published in the Undergraduate Catalog. VWW are upper-division courses (300-400 level) and should be taken in a student's junior/senior year. One of the VWW must be taken in a college different than the student's home college, i.e. the College of Engineering in the case of Engineering Physics students. The other VWW course can be taken in the student's college, but (1) it must be in a different department, (2) may not be cross-listed with the student's home department, and (3) cannot be counted as one of the requirements for the student's major. Until the 2009-2010 catalog, students were also allowed to satisfy 3 credits of VWW by taking 9 credits of upper-division courses (300-level and above) in a college different than their own (9-credit rule), as outlined in the Undergraduate Catalog.

College-Specific Requirements

The College of Engineering at NMSU has no specific additional course requirements, beyond those listed under university-specific requirements. However, the College of Engineering expects all engineering students to satisfy the following requirements:

- earn a cumulative grade-point average of 2.0 or better before enrolling in engineering courses numbered 300 or above,
- complete all of the required pre-requisites and courses in engineering, technology, math and sciences with a grade C or better
- fulfill all university-, college- and program-specific degree requirements.

Program-Specific Requirements

Since 2008, the BS in Engineering Physics (EP) at NMSU is offered with 4 different concentrations:

- *Aerospace Engineering,*
- *Chemical Engineering,*
- *Electrical Engineering,*
- *Mechanical Engineering.*

Throughout the document, we will use *Aerospace*, *Chemical*, *Electrical* and *Mechanical concentration* for brevity reasons (Engineering being implied).

The Engineering Physics program is administered by a standing Engineering Physics Program Committee, as outlined in the previous section - Background Information. The Engineering Physics Program Committee designs, implements and continuously re-assesses the curricula and course requirements for each of the Engineering Physics concentrations. The Engineering Physics Program Committee consults with and seeks approval from the Heads of participating departments (Physics, Mechanical & Aerospace, Electrical and Chemical) and the Associate Dean of Engineering for Academics prior to making any major changes to any of the program's concentrations.

Program-specific requirements for engineering courses differ between different concentrations, but all concentrations have similar cores of math, physics and other sciences courses. With the exception a few (more recent) capstone design projects, there are no courses solely for Engineering Physics. Engineering Physics students take the same physics and engineering courses, taken by the majors of respective programs of participating departments.

Program-specific requirements are published in the Undergraduate Catalog and they are implemented and kept up-to-date in STAR. Moreover, the Department of Physics developed appropriate flowcharts and checklists for each concentration's requirements, which are posted on the web. Common to all concentrations, Engineering Physics students are expected to satisfy the following:

- a cumulative grade-point average of 2.0 or better at the time of graduation,
- a grade of C or better for all courses required for the major,
- fulfill all university-specific degree requirements.

Notice of Degree Candidacy

Early in the semester, during which graduation requirements are expected to be completed, a student must file an on-line *Notice of Degree Candidacy* with the Registrar's Office. Names of candidates are forwarded to the Associate Dean of Engineering for Academics. The candidate names are then passed to the appropriate departments.

In the case of Engineering Physics, it is the Chair of the Engineering Physics Program Committee, who checks each student's academic record against the program's degree requirements using the STAR audit. In addition, the electronic copies of the most recent degree check lists (in pdf format) are available at http://engineeringphysics.nmsu.edu/forms.html, and copies are also provided in *Supplementary Documentation.* The result of each record check is then forwarded to the Associate Dean's office for final validation. A Records Specialist in the Associate Dean's office goes through each record check to verify its accuracy. Finally, the Associate Dean goes through the records checks as a third and final verification.

Inconsistencies such as missing classes, unacceptable grades, or invalid elective choices are brought to the attention of the Engineering Physics Committee Chair and an explanation or correction is requested. It is fairly common that inconsistencies are can be resolved with exceptions/substitutions. Once all inconsistencies are resolved, the Associate Dean endorses the record check, signifying that all degree requirements have been met. Unresolved inconsistencies result in the student being informed of the problem and advised they will not graduate until the situation is corrected. In all events, the Registrar is notified of the Associate Dean's decision.

F. 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 2011-2012 APPM, Section II.G.4.a.)

Student transcripts from most recent Engineering Physics graduates will be provided upon request. As outlined above, the Engineering Physics degree is presently offered with 4 different concentrations: *Aerospace*, *Chemical*, *Electrical* or *Mechanical Engineering*. While the graduation requirements differ for each concentration. To date, no Engineering Physics student graduated with the (relatively new) *Chemical concentration* and only one with the (relatively new) *Aerospace concentration*, while approximately 10 students graduated with each the *Mechanical* and *Electrical concentrations*. Transcripts list Engineering Physics as the major for all students, regardless of their particular concentration.

Criterion 2: Program Educational Objectives

Engineering Physics

Bachelor of Science in Engineering Physics

Self-Study Report

New Mexico State University

June 2012

CRITERION 2. PROGRAM EDUCATIONAL OBJECTIVES

This chapter describes the *Program Educational Objectives* and the processes in place to assess constituency and program needs, as well as the selection and evaluation of the educational objectives and their connection to *Institutional Educational Objectives*.

The Engineering Physics (EP) *Program Educational Objectives* were derived from strategic discussion among the Engineering Advisory Board, faculty members and staff of the Engineering Physics Program, the Mechanical Engineering Department, the Electrical Engineering Department, the College of Engineering and the University. Preparation for the ABET 2012 review has had a significant impact on the development and improvement of the educational objectives for the Engineering Physics program.

A. Mission Statement

Provide the institutional mission statement.

The mission statement for New Mexico State University 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 for the 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 for the Engineering Physics Program is as follows:

> *The mission of Engineering Physics at New Mexico State University is to offer an ABET-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 Engineering Physics Program Committee (with input from our External Advisory Board and representatives from the Chemical Engineering, the Mechanical & Aerospace and the Electrical Engineering programs) has recently established a 'new' set of *Program Educational Objectives* in order to best serve the needs of our constituencies and to best achieve the goals stated in the various mission statements above. The current *Program Educational Objectives* of the Engineering Physics program are listed in Table 2.1.

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

• **EP Objective 1: Competitiveness.** Graduates are competitive in internationally-recognized academic, government and industrial environments;
• **EP Objective 2: Adaptability.** Graduates exhibit success in solving complex technical problems in a broad range of disciplines subject to quality engineering processes;
• **EP Objective 3: Teamwork and Leadership.** Graduates have a proven ability to function as part of and/or lead interdisciplinary teams.

These *Program Educational Objectives* may be found by the general public on our Engineering Physics website at engineeringphysics.nmsu.edu.

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.

The *Program Educational Objectives* of the Engineering Physics program are consistent with and supportive of the institutional educational objectives of both, the College of Engineering and New Mexico State University as a whole. NMSU strategic planning activities originate at the highest level of the University in the President's office, and each of the Colleges, departments and supporting units are required to produce their own strategic plan that supports and is consistent with the overall plan of the University. In this section, we will establish the relationship of the strategic mission statements of the University, the College and the Engineering Physics program.

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.

NMSU has long supported and participated in a variety of strategic planning activities. 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 a number of 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 have to 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)*.

The program goals and objectives of the University are listed in the *Strategic Directions Pamphlet* distributed to every NMSU employee. In undergraduate education, the University strives to enhance the undergraduate experience and maintain NMSU as *the university of choice* for New Mexico residents. Table 2.2 summarizes the educational objectives of the University designed to achieve this goal.

Table 2.2. *Educational Objectives of NMSU* for undergraduate education.

- **NMSU Objective 1: Academic Recognition.** To be nationally and internationally recognized for its academic programs at all academic levels
- **NMSU Objective 2: Program Quality.** To have high quality, diverse faculty, staff and student body at all academic levels.
- **NMSU Objective 3: Recognition in Research**. To be nationally and internationally recognized in research and creative activity
- **NMSU Objective 4: Economic Engine.** To serve as an engine for economic, social, educational and community development in New Mexico.
- **NMSU Objective 5: Stewardship.** To be an excellent steward of all resources.

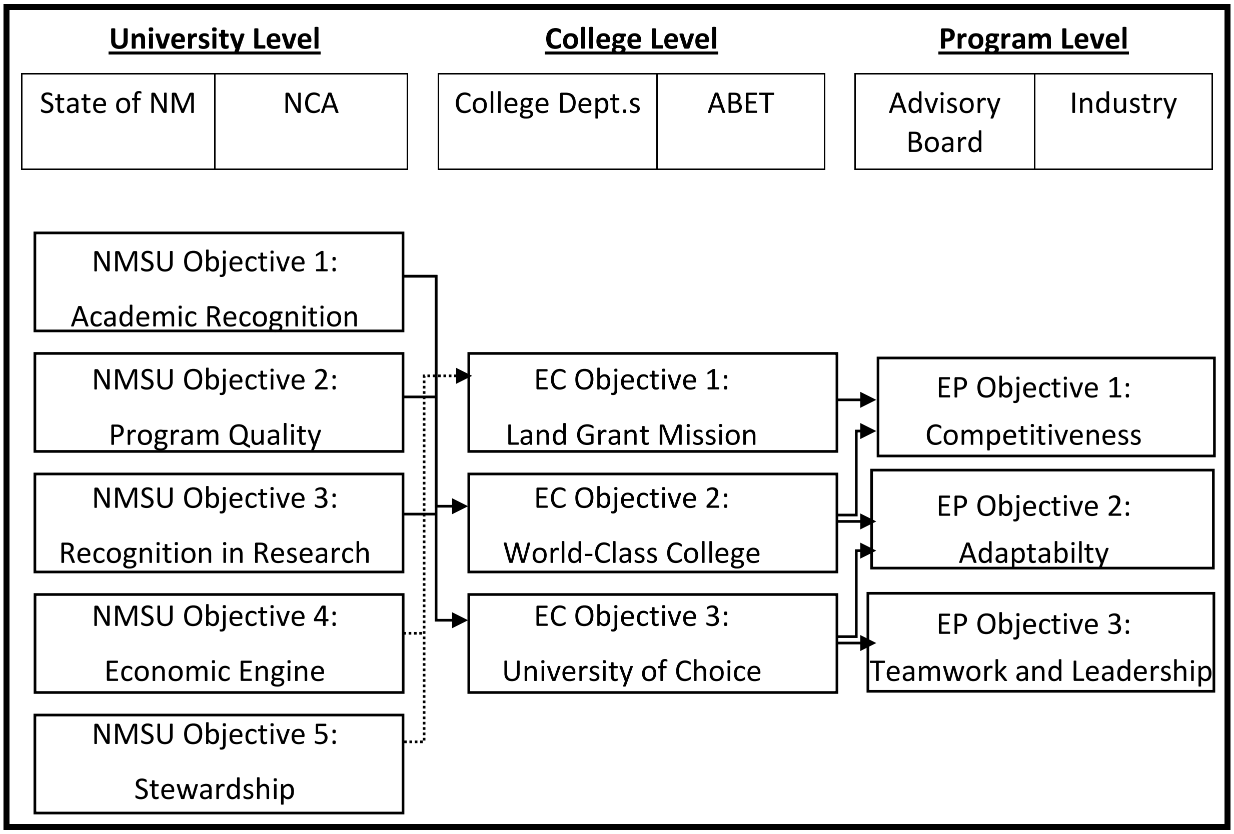
The Engineering Physics degree is administered by the College of Engineering, and as such it ought to be consistent with the educational objectives stated by the College of Engineering. The College of Engineering has established three main engineering-specific educational objectives for undergraduate education, and those are published in the *Strategic Plan of the College*. These objectives are listed in table 2.3

Table 2.3. Educational Objectives of NMSU's College of Engineering (EC) or undergraduate education.

- **EC Objective 1: Land Grant Mission:** The College of Engineering will uphold the land-grant mission of NMSU through nationally recognized programs in education, research, and professional and public service.
- **EC Objective 2: World-Class College.** Provide world-class engineers and engineering technologists for industrial, government, and academic constituents of the College of Engineering.
- **EC Objective 3: University of Choice.** To be the "University of Choice" for undergraduate engineering and engineering technology education in the region.

Diagram 2.1 indicates the relationships between the educational objectives of the University as a whole, the ones of the College of Engineering and the ones of our Engineering Physics program. Obviously, the EP *Educational Objectives* are well aligned with the ones of the university and the college.

Diagram 2.1: Relationship of institutional university- (NMSU) and college-level (EC) Educational Objectives with the Engineering Physics (EP) Educational Objectives.



D. Program Constituencies

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

The NMSU Engineering Physics (EP) program is administered by the College of Engineering, but it is run by the Department of Physics in the College of Arts & Sciences. The EP program is administered by the Department of Physics but is a cooperative program with the Department of Chemical Engineering, Department of Mechanical & Aerospace Engineering and the Department of Electrical Engineering. Students select a specialization (concentrations) in Chemical Engineering (ChE), Mechanical Engineering (ME), Aerospace Engineering (AE) or Electrical Engineering (EE).

The Engineering Physics program has been designed such that students acquire strong fundamental knowledge in physics and the chosen engineering fields, 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 Engineering Physics 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 Engineering Physics 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 Engineering Physics 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.

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

Engineering Physics (EP) students

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

Potential Employers *(Industry, Academia, Government)*

This is probably the most important constituency group, and it is strongly represented on our External Advisory Board. The external advisory board meets once every year, typically in the spring semester. These meetings began in 2004. Members of the board provide important feedback to all aspects of the Engineering Physics program, such as required skills of graduates, educational objectives and outcomes assessment. The advisory board evaluates the overall program, identifies its strength and weaknesses and provides a written report that includes suggestions on how to improve the program. Apart from input through the advisory board, many of our faculty and staff members have close interactions with representatives from industry and national laboratories, and their comments and suggestions are taken into account as well. The present members of the Engineering Physics External Advisory Board (EPAB) are listed in Table 2.4.

Table 2.4: Members of the 2011/2012 External Advisory Board of Engineering Physics program at NMSU.

Dr. Steven Castillo, Sandia National Laboratories, Albuquerque, New Mexico
Dr. Jon Haas (Acting 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
Dr. Mark Schraad, Los Alamos National Laboratory; Los Alamos, New Mexico
Dr. John Schaub *(Alumnus)*; Valparaiso University, Indiana
Dr. Ronald Tafoya, Intel Corporation; Albuquerque, New Mexico

Complete memberships of past External Advisory Boards are provided in *Supplementary Documentation.* In general, the Engineering Physics program hosts a 1-2 day on-campus meeting with the External Advisory Board annually.

Physics Faculty and Staff

The Department of Physics holds an annual retreat 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 Engineering Physics program, the Department of Physics has created an Engineering Physics 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 Teaching are *ex-officio* members of this committee. Current membership of the Engineering Physics Program Committee can be found in the first section of this Self-Study Document (*Background Information*). The Engineering Physics 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. Although the Engineering Physics Program Committee ultimately directs all aspects of the Engineering Physics program, it relies heavily on the involvement of other faculty members in the Department of Physics and the participating Engineering Department for the ABET accreditation process as well as progress within the program. For example, this ABET Self-Study Report was produced by a collective effort involving all of the faculty members in the Department of Physics in order to ensure broad faculty participation and support. Members of the Engineering Physics Program Committee then merged individual contribution into a single document that is presented here.

Faculty of affiliated Engineering Programs

The Department of Mechanical & Aerospace Engineering, Chemical Engineering and Electrical Engineering have representatives on the Engineering Physics 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 Engineering Physics program at their respective home departments in the College of Engineering.

Alumni

Since its inception, the Department of Physics has tried to keep an updated list of its alumni, their addresses and their present occupation. In many cases, the department has succeeded to keep close contact with past alumni as it performs annual alumni surveys. Moreover, each of the External Advisory Boards has had alumni representation on the board.

Peer Institutions that offer Engineering Physics or similar majors

We are in close contact with other academic institutions (for example, the Colorado School of Mines and Southeast Missouri State University) that also offer an Engineering Physics Programs, accredited by ABET. The External Advisory Board has a representative from such peer institutions, and we built on their experience for program progress and accreditation purposes.

Graduate Schools

Graduate schools are an important potential destination for our students. Several of our alumni pursued advanced graduate studies in physics or engineering following their graduation from the Engineering Physics program. The curricula of the pre-existing physics and engineering programs are therefore tailored for the needs of students seeking graduate education. The External Advisory Board could benefit from some representation from graduate programs.

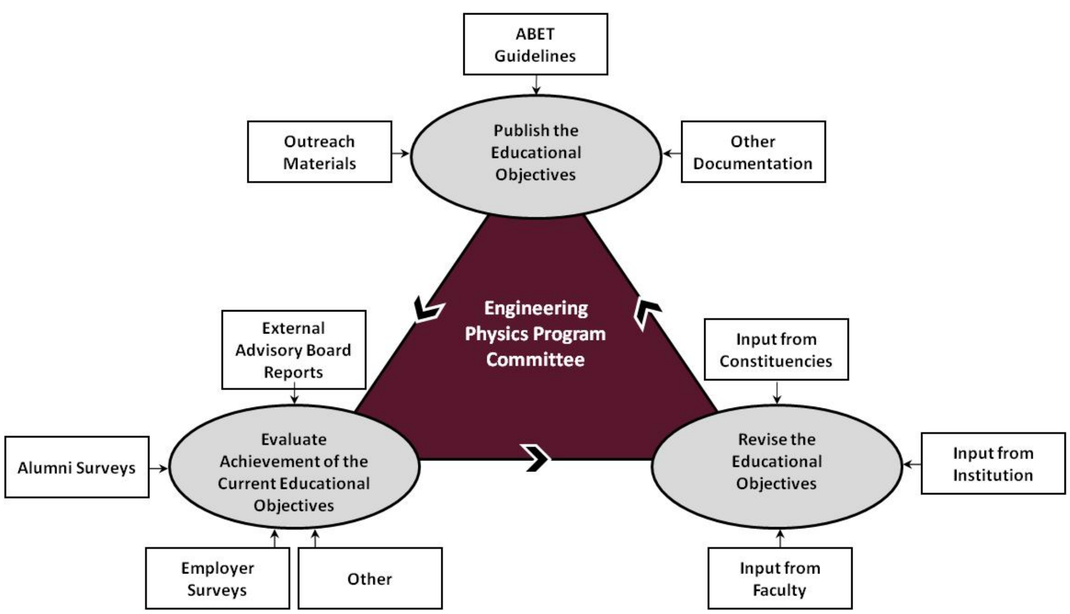
Each of the constituency groups plays an important, and often complementary, role in both the evaluation and the improvement of our Engineering Physics program. Input from our constituencies is included in the assessment of the program and we aggressively solicit their assistance in further development of our program.

E. Process of Evaluating and Improving Educational Objectives

Describe the process that periodically reviews and revises, as necessary, the program Educational Objectives including how the program's various constituencies are involved in this process. Include the results of this process and provide a description of any changes that were made to the program educational objectives and the timeline associated with those changes since the last general review.

The process of defining and revising the *Program Educational Objectives* for our Engineering Physics program is an ongoing and continuous process. The Engineering Physics Program Committee is committed to continually measure, analyze and improve the *Educational Objectives*. The *Program Educational Objectives* need to be embedded into the educational goals and objectives of the institution, as stated in its mission plan. The process for establishing the *Program Educational Objectives* is shown in Diagram 2.2. The process involves three major steps, which are described next.

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



Evaluate Achievement of the Current Educational Objectives

There is a need to implement the constituency needs into the program such that it is consistent with and supportive of the strategic mission of the university and its units. Each year, program needs are addressed by the Engineering Physics Program Committee, involving faculty of the Engineering Physics program and participating engineering departments and with the advice of the Engineering Physics External Advisory Board. Alumni Surveys are probably the most important measure of achievement. Another important indicator may be Employer Surveys or other data.

Revise the Educational Objectives

If needed, adjustments and improvements to the educational objectives are discussed by the Engineering Physics Program Committee, which will suggest changes and/or modifications to the objectives. Prior to implementing such changes, we will seek the advice and input from our constituencies, faculty members and institutional entities. The development of the *Program Educational Objectives* is closely tied to the departmental and institutional strategic plans.

Publish the Educational Objectives

The Engineering Physics Program Committee formulates and publishes any revisions of the Program Educational Objectives, if changes have been made since the previous year. The Educational Objectives are formulated such that they capture the spirit of ABET's guidelines for Educational Objectives. The Program Educational are prominently displayed on any kind of outreach material, such as the engineering physics website, recruitment fliers etc.

Material directly connected to the *Educational Objectives* is filed in the *'Black' Objectives Notebook* (called 'black' because of the color of its binder). The contents of the *Objectives Notebook* are listed below.

- **'Black' Objectives Notebook** (filled in as needed)
    - Engineering Physics Program Committee meeting minutes
    - External Advisory Board Reports and meeting minutes
    - Survey Interviews
    - Exit interviews for graduating Engineering Physics students
    - Other material (employer surveys, statistics etc.)

Educational Objectives – Corrective Action

In the fall of 2011, the Engineering Physics Program Committee realized that the previously stated *Educational Objectives* were no longer fully consistent with the most current definition for *Program Educational Objectives* by ABET.

Prompted by this change, the Engineering Physics Program Committee called an External Advisory Board to seek input into how to re-define the program's educational objectives. The External Advisory Board met on the NMSU campus with members of the Engineering Physics Program Committee and other faculty in January 2012. The External Advisory Board was tasked in particular to come up with some recommendation for the revision of the program's educational objectives. After a presentation given to the board outlining the need for modifications and a subsequent review of the various mission statements, the board members can up with some initial recommendation. The board's recommendation were then condensed and summarized by the Engineering Physics Program Committee, and then put up for discussion with the rest of the physics faculty. The final version of the new set of *Program Educational Objectives* (that were introduced here) was completed soon thereafter.

Criterion 3: Student Outcomes

Engineering Physics

Bachelor of Science in Engineering Physics

Self-Study Report

New Mexico State University

June 2012

CRITERION 3. STUDENT OUTCOMES

A. Student Outcomes

Describe the process used for establishing and revising student outcomes.

The Engineering Physics program uses the resources of five different programs: Engineering Physics, Aerospace Engineering, Chemical Engineering, Chemical Engineering and Mechanical Engineering (hosted in four different departments), Except for Aerospace Engineering (which applies for accreditation for the first time in 2012), all other programs are currently ABET accredited programs and are preparing for re-accreditation. All of the above programs have a common set of *Program Outcomes (a)-(k)* that are required by ABET. While the other engineering programs have program-specific outcomes as well, this is not the case for Engineering Physics.

The different programs have established outcomes and assessment procedures for each of their courses in order to assess the *Program Outcomes (a)-(k)*. For assessment of these outcomes in engineering course, the Engineering Physics program relies on the other engineering programs' current procedures. For assessment of these outcomes in physics courses, the Department of Physics has implemented their own assessment processes and procedures, as will be outlined below. Assessment done in the engineering departments will not be discussed here since each engineering programs provide their self-study reports. It should be noted, however, that curricular changes (e.g. course delivery and content) in participating engineering departments may affect the Engineering Physics program as well. For that reason, representatives of these departments sit on the Engineering Physics Program Committee. If needed, these engineering representatives will disseminate and discuss the internal findings, assessment results and proposed courses of action. In addition, these representatives help develop and change assessment procedures, as appropriate. The separate assessment responsibilities for physics and engineering courses are actually beneficial since each program outcome is assessed independently and therefore complementary or supplementary data exist. This makes for a particularly strong program.

After consultation with faculty members from the College of Engineering and Department of Physics, the Engineering Physics External Advisory Board, industry representatives, and current students and graduates, it was concluded that the ABET 2012 *Program Outcomes (a)* thru *(k)* would continue suffice to ensure the quality of our Engineering Physics program. In addition, these outcomes are common to the all the engineering programs, making the cross-departmental Engineering Physics assessment easier. Subsequently, we adopted ABET 2000 Program Outcomes, with some minor addition in the *Program Outcomes (e)*, *(h)* and *(k)*, where we included 'physics' specifically.

Our EP Program Outcomes, each named for future reference, are given in Table 3.1.

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.

Below, we provide a more detailed description and the common measurements for each of the above program outcomes.

(a) **Scientific Expertise:** EP graduates understand the basic concepts, notation and techniques in fundamental disciplines of physics and engineering, such as mechanics, electromagnetism, thermodynamics and modern physics. The Force Concept Inventory given at the freshman and junior levels are used for many courses. Freshman courses often use the Mastering Physics online homework system. This system includes the ability to measure outcomes from subsets of homework. For example, the skill builder problems can be used to measure Scientific Expertise. Other courses used standardized questions of a specific type embedded in tests and quizzes.

(b) **Experimental Training:** EP graduates will be able to perform fundamental experimental studies in physics and engineering, and they will be able to analyze the data. This outcome is measured in laboratory courses. Outcomes are based on questions embedded in final exams or the instructor assessment of students and groups.

(c) **Design Abilities:** EP graduates can design and implement an experimental or theoretical study to tackle physics problems in an applied context, such as economic, environmental, or societal. This outcome is measured in upper division lab courses or computer courses.

Instructors have used the ability to design a particular piece of software code or the ability to set up and run a particular experiment.

(d) **Teamwork:** EP graduates learn to work as effective members of a team, and they will be able to take responsibility for some or all aspects of a common goal. This outcome is measured in upper-division lab courses based on peer-evaluation of group performance.

(e) **Problem Solving:** EP graduates use the existing scientific understanding and models to solve physics and engineering problems. The common measure of this outcome is based on Graduate Research Exam (GRE) questions embedded in quizzes and exams.

(f) **Professional Responsibility:** EP graduates will demonstrate high standards of ethics and integrity in their professional activities. This outcome is measured through written reports in selected classes. One instructor used the student completion rate of homework and in-class worksheets to indicate if the students were being responsible for completing homework and attending class. Students are also expected to pass a radiation safety course.

(g) **Communication Skills:** EP graduates will be able to present information (both, orally and written) in an effective, well-organized, logical and scientifically-sound manner. This outcome is measured through the use of both written and oral reports in upper-division classes.

(h) **Societal Impact:** EP graduates will appreciate the human dimension and the impact of their profession in a diverse social, cultural and economic environment. Laboratory reports and oral reports were used to assess societal impact.

(i) **Life-long Learning:** EP graduates will understand the need for life-long learning in order to accommodate rapid changes in science and technology. Written and oral reports were used to assess this outcome. Some instructors have also used embedded test questions that required understanding of issues of current topical interest.

(j) **Contemporary Issues:** In order to be effective members of the society throughout their careers, EP graduates have to understand the need to be current on important issues within their discipline and profession. Both written and oral reports were graded for the selection of content by the students.

(k) **Technical Know-How:** EP graduates will be able to use or understand how to use widely-spread state-of-the-art tools used in modern engineering practice. Instructors used in-lab observation and questions from the Fundamentals of Engineering exam (FE exam) to rate this outcome.

The curriculum of our Engineering Physics program and the content of the courses have been designed such that there are multiple independent measures for achievement of our *Program Outcomes (a)* thru *(k)*. In table 3.2.a, the correspondences of program outcomes with the Physics courses required in the Engineering Physics program is shown. The last row in the table indicates how often a particular program outcome is expected to be measured throughout the complete Engineering Physics program. Note, that some of the rows contain two courses, both of which will measure the same program outcomes. In some cases, the two courses may be alternative options (e.g. *PHYS 213* or *PHYS 215*). In other cases, however, the two courses may be both required and will be taken in sequence (e.g. *PHYS 454* and *455*, or *PHYS 461* and *462*), thus providing two independent measures of particular program outcomes. Each faculty member is responsible for measuring the appropriate outcomes. These are documented in the instructors *Post Instruction Comment Form* and put into a binder for that course. Each year the Department of Physics prepares a review for each outcome that uses these data and discusses any changes that need to be made in the program. The outcome reviews are kept in a separate folder.

Two classes have been dropped from the curriculum *Physics 470 – Physical Optics* and *Physics 471 - Modern Experimental Optics*, and we introduced *Physics 473 - Introduction to Optics* and *Physics 395 - Intermediate Mathematical Methods of Physics*.

Similar to Physics, the participating engineering program developed own assessment matrices for their engineering courses, as shown in Table 3.2.b-e. For the engineering courses, assessment of the *Program Outcomes (a)-(k)* is done in the engineering department, which hosts that particular program for their majors, i.e. the Department of Electrical Engineering will assess EE courses, the Department of Mechanical & Aerospace Engineering will assess AE and ME courses, and the Department of Chemical Engineering will assess ChE courses. Since Engineering Physics students do not have the same course requirements in their concentration compared to the majors in that particular engineering degree, the engineering assessment will not necessarily cover every single of those program outcomes independently (although it typically covers most of them) for every single Engineering Physics student. Moreover, the AE and ME programs do not assess *Program Outcome (h) – Societal Impact* in any of their own program courses. These two program outcomes utilize the university's General Education requirements for assessment of this particular outcome.

It should also be noted that NMSU's Aerospace Engineering is a fairly new (but rapidly growing) program, which was introduced in 2006. While the AE program has been successful in building the infrastructure (personnel, facilities) to run the program, offerings of AE-specific courses are still fairly limited (i.e. there are no present AE electives). Our Engineering Physics students with the *Aerospace concentration* are required to take all of the AE courses presently offered, as is the case also for the AE majors. Currently, AE electives are not yet offered on a regular basis, and AE students are required to take specialized upper-level courses in Mechanical, Electrical and Chemical Engineering, which our Engineering Physics students with the *Aerospace concentration* do not need to take.

Table 3.2.a. Assessment Matrix showing the Correspondence of *Program Outcomes (a)* thru *(k)* to Physics courses of the Engineering Physics degree.

Physics Courses	**Program Outcome**										
	***(a)* Scientific Expertise**	***(b)* Exp. Training**	***(c)* Design Abilities**	***(d)* Teamwork**	***(e)* Problem Solving**	***(f)* Prof. Responsib.**	***(g)* Comm. Skills**	***(h)* Societal Impact**	***(i)* Life-long Learning**	***(j)* Contemp. Issues**	***(k)* Technical Know-How**
***Core Courses*[1)]**											
Physics 213 or 215 Mechanics	**X**										
Physics 213L or 215L Mechanics Lab		**X**									
Physics 214 or 216 Electr. & Magn.	**X**										
Physics 214L or 216L Electr, & Magn. Lab		**X**									
Physics 217 Heat, Light & Sound	**X**										
Physics 217L Heat, Light &Sound Lab		**X**	**N**	**N**							
Physics 315 Modern Physics	**X**					**X**		**X**	**X**	**X**	
Physics 315L Modern Physics Lab		**X**	**a**	**X**			**X**				**X**
Physics 395 Math Methods *(new)*						**N**					
Physics 451 Interm. Mechanics					**X**						
Physics 454 and 455 Int. Mod. Phys. I & II					**X**						

Table 3.2.a. - continued

Physics Courses	Program Outcome										
	(a)	*(b)*	*(c)*	*(d)*	*(e)*	*(f)*	*(g)*	*(h)*	*(i)*	*(j)*	*(k)*
Physics 461 and 462 Int. El. & Magn. I & **II**					**X**						
Physics 475 Adv. Exp. Phys. Lab		**X**	**a**	**X**			**X**				**X**
Physics 480 Thermodynamics					**X**						
Electives											
Physics 305V Water in Solar System						**X**		**X**	**X**	**X**	
Physics 450 Capstone design			**X**	**X**			**X**				**X**
Physics 471 Exp. Optics Lab		**X**	**a**	**X**			**X**				**X**
Physics/EE 473 Intro. Optics *(new)*						**N**					
Physics 495 Math. Methods II											**X**
Physics 488 Solid State Physics						**X**		**X**	**X**	**X**	
Physics 489 Modern Materials						**X**		**X**	**X**	**X**	
Other Physics Elective			**a**	**a**		**a**		**a**	**a**	**a**	**a**
Number of times an outcome is measured	***4***	***5***	***up to 3***	***2-3***	***6***	***1-2***	***2***	***1-2***	***1-2***	***1-2***	***3-4***

[1)]Some of the core courses may not be required by Engineering Physics students, depending on the actual engineering concentration.
a: whether this Program Outcome will be measured depends on the individual instructor and/or the topic of the course
N: indicates a new course, i.e. a new assessment

Table 3.2.b. Assessment Matrix showing the Correspondence of *Program Outcomes (a)* thru *(k)* with Electrical Engineering courses of the Engineering Physics degree with the *Electrical concentration*.

Electrical Engineering Courses	Program Outcome										
	(a) Scientific Expertise	*(b)* Exp. Training	*(c)* Design Abilities	*(d)* Teamwork	*(e)* Problem Solving	*(f)* Prof. Responsib.	*(g)* Comm. Skills	*(h)* Societal Impact	*(i)* Life-long Learning	*(j)* Contemp. Issues	*(k)* Technical Know-How
Core Courses											
EE 161 Comp Aid. Probl. Solv.				**X**	**X**		**X**				**X**
EE 162 Dig. Circuit Des.	**X**		**X**	**X**							**X**
EE 210 Eng. Anal. I	**X**	**X**			**X**						**X**
EE 260 Embedded Systems	**X**		**X**		**X**						**X**
EE 280 AC & DC circuits	**X**	**X**	**X**	**X**	**X**	**X**	**X**				**X**
EE 310 Eng. Anal. II	**X**				**X**						**X**
EE 312 Signals & Syst. I	**X**				**X**						**X**
EE 351 Appl. Electromagn.	**X**			**X**	**X**						**X**
EE 380 Electronics I	**X**		**X**				**X**				**X**
EE 418 Capstone I			**X**	**X**	**X**		**X**	**X**			**X**
EE 419 Capstone II			**X**	**X**			**X**				

Table 3.2.b. - continued

EE Courses	Program Outcome										
	(a)	*(b)*	*(c)*	*(d)*	*(e)*	*(f)*	*(g)*	*(h)*	*(i)*	*(j)*	*(k)*
Electives											
EE 314 Signals & Syst. II	**X**				**X**						**X**
EE 363 Comp. Syst. Arch.	**X**					**X**		**X**		**X**	
EE 391 El. Power Eng.	**X**	**X**	**X**	**X**		**X**	**X**			**X**	**X**
EE 425 Semicond. Dev.	**X**										**X**
EE 431 Power Syst. II	**X**										**X**
EE 473 Intro Optics	**X**		**X**		**X**		**X**				**X**
EE 478 Opt. Sources & Detect.	**X**	**X**	**X**	**X**	**X**		**X**		**X**		**X**
EE 486 Dig. VLSI Des.	**X**		**X**			**X**		**X**		**X**	**X**
Other EE Elective	**a**	**a**	**a**	**a**	**a**	**a**	**a**	**a**	**a**	**a**	**a**

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

Table 3.2.c. Assessment Matrix showing the Correspondence of *Program Outcomes (a)* thru *(k)* with Mechanical Engineering courses of the Engineering Physics degree with the *Mechanical concentration*.

Electrical Engineering Courses	Program Outcome										
	(a) **Scientific Expertise**	***(b)*** **Exp. Training**	***(c)*** **Design Abilities**	***(d)*** **Teamwork**	***(e)*** **Problem Solving**	***(f)*** **Prof. Responsib.**	***(g)*** **Comm. Skills**	***(h)*** **Societal Impact**	***(i)*** **Life-long Learning**	***(j)*** **Contemp. Issues**	***(k)*** **Technical Know-How**
Core Courses											
ME 102 ME Orientation			X			X					
ME 159 Graph. Comm. & Des.			X								X
ME 236 Eng. Mechanics I	X				X						X
ME 237 Eng. Mechanics II	X				X						
ME 240 Thermodynamics					X						
ME 261 ME Probl. Solv.	X				X						X
ME 326 Mech. Design			X	X		X				X	
ME 328 Eng. Anal. I	X										
ME 333 Int. Dynamics					X						
ME 338 Appl. Electromagn.	X	X	X		X						
ME 341 Heat Transfer	X				X						

Table 3.2.c. - continued

ME Courses	Program Outcome										
	(a)	*(b)*	*(c)*	*(d)*	*(e)*	*(f)*	*(g)*	*(h)*	*(i)*	*(j)*	*(k)*
ME 425 Des. Machine Elements	**X**		**X**		**X**						**X**
ME 426/427 Design Proj. Lab. I & II			**X**	**X**			**X**				
ME 449 Senior Seminar						**X**	**X**		**X**	**X**	
Electives											
ME 329 Eng. Anal. II	**X**										**X**
ME 331 Int. Strength Mat.						**X**					
ME 338 Fluid Mech.	**X**	**X**	**X**		**X**						
ME 445 Exp. Methods II		**X**			**X**		**X**				**X**
Other EE Elective	**a**	**a**	**a**	**a**	**a**	**a**	**a**		**a**	**a**	**a**

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

Table 3.2.d. Assessment Matrix showing the Correspondence of *Program Outcomes (a)* thru *(k)* with Aerospace Engineering courses of the Engineering Physics degree with the *Aerospace concentration*.

Electrical Engineering Courses	Program Outcome										
	(a) Scientific Expertise	*(b)* Exp. Training	*(c)* Design Abilities	*(d)* Teamwork	*(e)* Problem Solving	*(f)* Prof. Responsib.	*(g)* Comm. Skills	*(h)* Societal Impact	*(i)* Life-long Learning	*(j)* Contemp. Issues	*(k)* Technical Know-How
Core Courses											
AE 339 Aerodynamics I	X	X	X		X						
AE 362 Orbital Mechanics.	X				X						X
AE 363 Aerosp. Struct.	X				X						X
AE 364 Flight Dyn. & Contr.	X				X						X
AE 419 Propulsion	X				X						X
AE 424 Aerosp. Syst. Eng.			X	X			X				
AE 428 Aerosp. Capst. Des.			X	X			X				
AE 439 Aerodynamics II	X				X						
AE 447 Aerofluidics Lab	X	X			X		X				

Table 3.2.e. Assessment Matrix showing the Correspondence of *Program Outcomes (a)* thru *(k)* with Chemical Engineering courses of the Engineering Physics degree with the *Chemical concentration*.

Chemical Engineering Courses	**Program Outcome**										
	(a) **Scientific Expertise**	***(b)*** **Exp. Training**	***(c)*** **Design Abilities**	***(d)*** **Teamwork**	***(e)*** **Problem Solving**	***(f)*** **Prof. Responsib.**	***(g)*** **Comm. Skills**	***(h)*** **Societal Impact**	***(i)*** **Life-long Learning**	***(j)*** **Contemp. Issues**	***(k)*** **Technical Know-How**
Core Courses											
ChE 111 Comp. Calc. in ChE	**X**										**X**
ChE 201 Mat. & Energy Bal.	**X**		**X**	**X**	**X**		**X**				**X**
ChE 301 ChE Thermodyn. I	**X**			**X**	**X**		**X**				**X**
ChE 302 and 302l ChE Thermodyn. II	**X**				**X**						**x**
ChE 305 Transport I: Fluids	**X**				**X**						
ChE 306 Transp. II: Heat & Mass	**X**		**X**		**X**						**X**
ChE 307 Transp. III: Staged Op.s	**X**		**X**		**X**						
ChE 361 Engineering Mat.	**X**										
ChE 361 Int. Dynamics	**X**							**X**			
ChE 441 Kinetics & React. Eng..	**X**				**X**						

Table 3.2.e. - continued

ChE Courses	Program Outcome										
	(a)	*(b)*	*(c)*	*(d)*	*(e)*	*(f)*	*(g)*	*(h)*	*(i)*	*(j)*	*(k)*
ChE 412 Proc. Dyn. & Contr.	**X**				**X**						
ChE 452L Chem. Proc. Sim.	**X**	**X**	**X**	**X**	**X**	**X**	**X**			**X**	**X**
ChE 455 Chem. Plant Des.	**X**		**X**		**X**	**X**	**X**			**X**	
ChE 490 Senior Seminar				**X**		**X**	**X**	**X**	**X**	**X**	
Other ChE Elective	**a**	**a**	**a**	**a**	**a**	**a**	**a**	**a**	**a**	**a**	**a**

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

Each of the participating departments publishes and distributes the respective assessment matrices among all of their faculty members and other instructors. Therefore, each course instructor knows which of the program outcomes are assigned to be measured in his/her course. It is up to the instructor of each course to come up with a way to quantitatively measure each of the assigned program outcomes. In most cases, instructors will utilize previously established assessment tools.

The Department of Physics has an established history of monitoring student progress and learning. In some cases, the tools used could easily be extended to measure particular program outcomes. However, there are no similar established assessment tools for many of the other program outcomes. In such cases, instructors had to develop their own outcomes-specific assignments, often under the guidance of the Engineering Physics Program Committee.

Emphasis was put on the desire that each of the program outcomes is measured by multiple courses and methods. Doing so, we made sure that the process is less dependent on individual courses, types of measurements, assessment methods or instructors. Below, we summarize some of the assessment approaches for the different program outcomes.

Nationally-normed tests

In general, we use standardized nationally-administered tests for measurements of achievement particularly for *Program Outcome (a) - Scientific Expertise* and *Program Outcome (e) - Problem Solving*.

For almost 15 years, the Department of Physics made use of *Graduate Record Exam (GRE)* questions in order to monitor student competitiveness at a national level. GRE questions are embedded in homework and/or exam problems, and the results can be taken as a direct measure of *Program Outcome (e) – Problem Solving*.

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

Most recently, the Department of Physics has begun using a senior-level test from the *Educational Testing Service (ETS) - the Physics Major Field Test*. This test was given at the end of the second semester of PHYS 455 (Quantum Mechanics II). The ETS test is a commercially-produced test that is widely used physics and engineering programs across the country. It provides nationally-normed measures for mechanics, electricity & magnetism, thermodynamics, and modern physics. The ETS test allows the course instructor to use individual scores for the second part of the exam as part of the course grade while using group scores for individual subjects to evaluate both *Program Outcome (a) - Scientific Expertise* and *Program Outcome (e) - Problem solving*.

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 developed by the Physics Education group

The Department of Physics is very fortunate to have Dr. Steve Kanim as one of its faculty members. Kanim's research is in Physics Education research and he developed many different (nationally recognized) exams and other probes to test student's conceptual understanding of physics,

As part of his research, he also developed much of the material for the introductory physics laboratories. Kanim's labs allow that student performance can be evaluated at several levels, one of which provides a measurement for *Program Outcome (b) – Experimental Training.*

As one of the results, Dr. Kanim co-authored the *E&M TIPERs; Electricity & Magnetism Tasks* (ISBN-10: 0131854992), which is used at several institutions in physics lab instruction.

Dr. Kanim also designed many of the standardized pre-requisite tests, which are given to students prior to each course. The purposed of the pre-requisite tests is to test whether students have been adequately prepared and remember the necessary material needed for taking a course. Although most pre-requisite test are not intended to measure any particular program outcomes, they are a very important ingredient to test the level of achievement and improve content delivery overall.

Assessment tools developed by Engineering Physics Program Committee

The Engineering Physics Program Committee designed a *Teamwork Evaluation Form* and an *Oral Report Evaluation Form* that can be used by individual instructors in order 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 can be accessed at http://engineeringphysics.nmsu.edu/forms.html, and copies are also provided in *Supplementary Information*.

Assessment tools developed by individual instructors

All other program outcomes, i.e. *Program Outcome (c) - Design Abilities*, *Program Outcome (f) – Professional Responsibility*, *Program Outcome (h) – Societal Impact*, *Program Outcome (i) – Life-long Learning*, *Program Outcome (j) – Contemporary Issues* and *Program Outcome (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 these particular outcomes, such as sub-scores in essays, class attendance, specialized assignments, class participation, completion percentage of assignments etc.

More details of the assessment tools for each individual program outcome are presented in *Criterion 4 – Continuous Improvement*.

Documentation for Assessment of Program Outcomes

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

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

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

As a practical matter, we began keeping the contents of each notebook online in 2008, and print them out for ABET assessment. Virtual notebooks are available to all faculty members and are deemed to be more accessible in that form.

In summary, the notebooks contain the following:

- **'Maroon' Instructor's Notebook** (prepared at the end of each course)
  - completed *Post-Course Instructor Comment Form*
  - supporting material for Assessment of *Program Outcomes (a)-(k)* (questions, tests, etc.)
  - syllabus and actual schedule followed
  - copies of exams, quizzes and homework, or references thereto.
  - copies of other class materials
- **'White' Course Notebook** (prepared for ABET review each cycle)
  - course outline and syllabus
  - copies of all assignments, i.e. pre-req. test, exams/labs/quizzes/homeworks/projects
  - exemplary copies of student work for each assignment (typically: high/medium/low)
  - hand-outs and other material used
  - summary of student evaluations

- **'Blue' Outcomes Notebook** (summarized yearly)
  - o Yearly summaries of outcomes assessment (this process was implemented in 2008)
  - o Yearly student progress reports

In the previous ABET cycle (2006-2012), we also required pre-requisite tests, grade summaries for tests and homeworks, and information about instructor evaluations in the Instructor's Notebooks. While this material was often useful for the instructors, some of the required material was not directly connected with the assessment results for the ABET *Program Outcomes (a) –(k).*

Furthermore, in the past the *Post-Course Instructor Comment Form* required a summary of the student evaluations, given at the end of the semester. Student evaluations are not immediately available to the instructor, and they often caused a delay in instructor submissions to *Instructor Notebook*. For the upcoming ABET cycle (2012-2018), we modified the submission requirements, so that the Instructor's Notebooks can be prepared at the same time class grades due.

B. Relationship of Student Outcomes to Program Educational Objectives

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

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

- **EP Objective 1: Competitiveness.** Graduates are competitive in internationally-recognized academic, government and industrial environments;
- **EP Objective 2: Adaptability.** Graduates exhibit success in solving complex technical problems in a broad range of disciplines subject to quality engineering processes;
- **EP Objective 3: Teamwork and Leadership.** Graduates have a proven ability to function as part of and/or lead interdisciplinary teams.

While the *Educational Objectives* are independently measured from measures based on the success of our alumni through surveys, interviews with alumni, and feedback of the External Advisory Board, there is a clear correlation between *Program Outcomes (a)-(k)* and *Educational Objectives EP 1-3*. Table 3.2 clarifies how the *Program Outcomes (a)* thru (*k)* support each of the above *Educational Objectives*. Each of the three *Educational Objectives* maps to multiple *Program Outcomes*. Strong correlations are marked with '**X**' in Table 3.2, secondary correlations marked with an '**s**'.

Table 3.3. Relationship between EP *Educational Objectives* and *Program Outcomes*. The relationships of primary importance are marked 'X', significant (but secondary) relationships are marked 's'; an empty box represents a negligible relationship.

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

Criterion 4: Continuous Improvement

Engineering Physics

Bachelor of Science in Engineering Physics

Self-Study Report

New Mexico State University

June 2012

CRITERION 4. CONTINUOUS IMPROVEMENT

This section discusses improvements of our Engineering Physics program during the last ABET cycle (2006-2012). In general, improvements were made as the result of a whole series of different assessment results, which can roughly be categorized into: program-quality, educational-objectives and program-outcomes assessments. The Department of Physics utilizes a well-defined set of approaches and tools for the different types of assessment, and their timelines are briefly summarized below.

Program-Quality Assessment – *Tools and Timeline*

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

The former is regularly assessed by the following means:

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

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

- ***Pre-requisite tests*** *(done for every physics undergraduate course each semester)*
  The Department of Physics introduced a pre-requisite test to be given in the 1st or 2nd class period. The main goal of the pre-requisite test is to identify whether previous instruction of necessary pre-requisite material was successful.
- ***Faculty annual performance evaluations*** *(once per year)*
  Each faculty member is required to submit a performance evaluation package every year. Teaching is part of these performance evaluations and the Department Head will discuss ways to address any identified weaknesses with the faculty member.

The latter relies on input from our constituencies, and it is assessed in the following ways:

- ***Input from External Advisory Board*** *(once per year)*

  The Engineering Physics External Advisory Board has members from all of the program's major constituencies. The board meets with physics faculty and other program representatives once every year on campus. The written reports provide guidance for the Engineering Physics curriculum.

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

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

Educational-Objectives Assessment – *Tools and Timeline*

Educational objectives are assessed by various approaches, which will be discussed in great detail in section *A. Program Educational Objectives* (see below). Except for alumni surveys, assessments of educational objectives tend to be mostly qualitative where the level of achievement is often implied. For their assessment, we used (or plan to use) the following tools:

- ***Alumni Surveys*** *(<u>once per year</u>)*

  The Department of Physics will approach a representative set of their Engineering Physics alumni once every year for a survey.

- ***Input from External Advisory Board*** *(<u>once per year</u>)*

  The board meets with physics faculty and other program representatives once every year on campus. A re-occurring task for the board is to evaluate whether the program is successful in achieving its Educational Objectives.

- ***Employer Survey*** *(proposed to be done <u>every other year</u>)*

  To date, we have not done any formal employer survey. The Engineering Physics Program Committee is presently developing such an adequate survey form.

<u>Program-Outcomes Assessment – *Tools and Timeline*</u>

The assessment of program outcomes will be discussed in great detail in section *B. Student Outcomes* (see below). For their assessment, we use (or plan to use) the following tools:

- ***Program-Outcomes Measures in Courses*** *(done for <u>every course each semester</u>)*

  For each relevant undergraduate course, instructors are asked to measure (one or more) program outcomes, as assigned by the Engineering Physics Outcomes matrix.

- ***Faculty Outcomes Reviews*** *(<u>once per year</u>)*

  Outcome reviews are now due along with the annual faculty performance evaluations, usually in October. Each faculty member is responsible for reviewing one outcome.

- ***Senior-Exit Interviews*** *(<u>every time when a student graduates from the program</u>)*

  The Physics Department Head will perform a formal exit interview using the Senior-Exit Form for each student in the graduating semester. The form has questions directly connected to program outcomes.

A. Program Educational Objectives

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

1. *A listing and description of the assessment processes used to gather the data upon which the evaluation of each the program educational objective is based. Examples of data collection processes may include, but are not limited to, employer surveys, graduate surveys, focus groups, industrial advisory committee meetings, or other processes that are relevant and appropriate to the program.*
2. *The frequency with which these assessment processes are carried out*
3. *The expected level of attainment for each of the program educational objectives*
4. *Summaries of the results of the evaluation processes and an analysis illustrating the extent to which each of the program educational objectives is being attained*
5. *How the results are documented and maintained*

<u>Current and Previous Educational Objectives</u>

As discussed in *Criterion 2*, the *Program Educational Objectives* for the Engineering Physics Program were modified in Spring of 2012 to address the newer ABET definition of objectives.

Current *Educational Objectives* are strongly focused on alumni several years past graduation. The newly formulated *Educational Objectives* are:

- **EP Objective 1: Competitiveness.** Graduates are competitive in internationally-recognized academic, government and industrial environments;
- **EP Objective 2: Adaptability.** Graduates exhibit success in solving complex technical problems in a broad range of disciplines subject to quality engineering processes;
- **EP Objective 3: Teamwork and Leadership.** Graduates have a proven ability to function as part of and/or lead interdisciplinary teams.

Contrary, the previous Educational Program Objectives focused on graduates at the time of their graduation, i.e. in the ability to be fully prepared for joining the workforce. At the time, the Engineering Physics program was new, and there were insufficient graduates who were several years out. The previous Educational Program Objectives had been:

- ***EP Objective 1 (old): Skills.*** *Develop skills pertinent to problem-solving in physics and engineering, including expertise in design, data collection, analysis and modeling, creative thinking, and effective communication and collaborative-working skills;*
- ***EP Objective 2 (old): Career Preparation.*** *Prepared graduates to begin productive careers in industry, governmental laboratories and academic institutions, or to continue to advanced study in either a chosen engineering field or in physics;*
- ***EP Objective 3 (old): Professional Adaptation.*** *Enable students to adapt as needs in the profession change;*
- ***EP Objective 4 (old): Ethics.*** *Instill in our students an understanding of their professional and ethical responsibilities, grounded in the real life conflicts they will encounter after leaving school.*

Although there are some obvious correlations between the current and previous sets of *Program Educational Objectives*, we feel that the current set better complies with the most recent definition by ABET and it better reflects the needs of our constituents. Nevertheless, it is important to point out the correlations, since past assessment was done with respect to the previous set of Objectives.

The '*new' Educational Objective 1 (Competitiveness)* can be correlated with the '*old' Objectives 1 (Skills) & 3 (Career Preparation),* although latter do not fully capture its spirit. In particular, we hope to train competiveness on the long term, not only at the time of graduation.

The '*new' Educational Objective 2 (Adaptability)* is basically the same as the '*old' Objective 3 (Professional Adaptation)* but its definition is now better refined.

The '*new' Educational Objective 3 (Teamwork and Leadership)* includes the '*old' Objective 4 (Ethics)* as one its components (not necessarily a major one). Leadership potential and teamwork abilities have been greatly emphasized by our constituents, and we strongly felt that it is necessary to list them in a separate objective.

Next, assessment processes, their frequency, level of attainment and documentation of the results are discussed first for the set of *'old' Program Educational Objectives* and then for the *'new' set of Program Educational Objectives*.

Assessment of 'old' Program Educational Objectives

In order to assess the level of achievement for the 'old' set of Objectives, we mostly used four (quantitative and qualitative) measures:

- Senior Exit Interviews (quantitative),
- Alumni Surveys (quantitative),
- Faculty Input (qualitative),
- Input from External Advisory Board (qualitative).

Senior Exit Interviews

1. Typically, graduating seniors will be given a formal exit interview that includes direct multiple questions for each of the standard ABET *Program Outcomes (a)-(k)*. A copy of the *Senior Exit Interview form* can be found at http://engineeringphysics.nmsu.edu/forms.html.
   - We used the answers for *Outcomes (a) - Scientific Expertise* and *(b) - Experimental Training* as a measure the level of achievement for the *EP Objective 1- Skills*.
   - We used the answers for *Outcomes (c) – Design Abilities, (e) Problem Solving, (g) Communication Skills* and *(k) – Technical Know-How* as a measure the level of achievement for the *EP Objective 2 - Career Preparation*.
   - We used the answers for *Outcomes (D) – Teamwork, (i)- Lifelong Learning* and *(j) – Contemporary Issues* as a measure the level of achievement for the *EP Objective 3- Professional Adaptation*.
   - We used the answers for *Outcomes (f) – Professional Responsibility* and *(h) – Societal Impact* as a measure the level of achievement for the *EP Objective 4- Ethics.*
2. Senior Exit Interviews are usually administered at the end of the graduating semester of a student. We collected exit interviews from12 students since Fall 2006.
3. Students answered each question using a scale where 1 = agree, 2 = neutral, 3 = disagree, and 4 = not important. If the average numerical value was higher than 2.0, we used this as an indicator that the target was not met. Table 4.1 lists the results for all *Program Outcomes (a)-(k)* from *Senior Exit Interviews*.
4. The average values for all program outcomes meet the target, except for the individual score for *Outcome (b) – Experimental Training*, which slightly missed its target. Taking into the above assignments between *Program Outcomes* and *Educational Objectives*, this finding indicates that graduates felt at the time of their graduation that all four of 'old' *Educational Objectives* have been met.
5. The Department of Physics keeps electronic copies of all *Senior Exit Interviews*, and hard copies are provided in the '*Black' Objectives Notebook*.

Table 4.1. Averaged values for responses for *Program Outcomes* received from *Senior Exit Interviews*. The table contains the average of responses (scale: 1 = agree, 2 = neutral, 3 = disagree, and 4 = not important) and the number of students responding.

	2007		2008		2009		2010		2011		2012		*average*
		N		N		N		N		N		N	
a. Scientific Expertise	1.0	1	1.0	2	1.7	1	1.2	3	2.0	2	1.7	3	***1.4***
b. Experimental Training	3.0	1	1.5	2	1.3	1	2.0	3	2.0	2	2.2	3	***2.1***
c. Design Abilities	2.3	1	1.5	2	1.7	1	1.3	3	1.2	2	2.1	3	***1.6***
d. Team-work	1.8	1	1.0	2	1.5	1	1.0	3	1.0	2	1.5	3	***1.2***
e. Problem Solving	1.0	1	1.0	2	1.0	1	1.0	3	1.8	2	1.5	3	***1.3***
f. Professional Respons.	1.8	1	2.0	2	2.0	1	1.0	3	1.5	2	2.0	3	***1.7***
g. Commun. Skills	1.8	1	2.0	2	3.0	1	1.3	3	1.5	2	1.8	3	***1.8***
h. Societal Impact	1.8	1	2.3	2	2.0	1	1.0	3	2.0	2	2.1	3	***1.8***
i. Life-long Learning	2.3	1	2.0	2	2.7	1	1.2	3	1.7	2	2.1	3	***1.9***
j. Contemp. Issues	1.8	1	1.5	2	1.0	1	1.0	3	1.8	2	1.9	3	***1.5***
k. Technical Know-How	1.0	1	2.0	2	1.4	1	1.3	3	1.4	2	2.1	3	***1.6***
												Total Average	***1.6***

Alumni Surveys

Alumni Surveys are used to see whether Engineering Physics graduates continue to feel that they had been well prepared once they have been embedded in the workforce for some period.

1. We developed a formal questionnaire, the *Alumni Survey Form*, which includes direct inquiries about each of the *Educational Objectives*.
2. The Department of Physics tries to stay in contact with their Engineering Physics alumni and attempts to contact them once every year. No survey was attempted in 2010 since the Physics building (Gardiner Hall) underwent major renovation and the faculty members were relocated to temporary housing for all of 2010. Alumni are typically contacted using their last known e-mail address. Responses from alumni can be fairly sporadic at times.
3. Unlike in senior exit interviews, the alumni survey used a different scale where 5 = strongly agree, 4 = agree, 3 = no opinion, 2 = disagree, and 1 = strongly disagree. Responses where the average was below 4.0 were used as an indicator that the target was not met. Table 4.2

lists all the combined average values for the *'old' Program Educational Objectives* obtained from Alumni Surveys. Responses from alumni who are more than 3 years past graduation are provided as well.

4. The average values indicate that the targets for the *'old' Educational Objectives EP 1 – Skills* and *EP 3 – Professional Adaptation* are met, while they are narrowly missed for *EP 2 – Career Preparation* (only in the combined score of recent and 3+ year alumni) and *EP 4 – Ethics*. The Department of Physics has made changes in order to improve level of achievement in those areas (see C. Continuous Improvement).
5. The Department of Physics keeps electronic copies of all *Alumni Survey Interviews*, and hard copies are provided in the *'Black' Objectives Notebook*.

Table 4.2. Averaged values for responses received from Alumni Surveys concerning *Program Educational Objectives.* The table contains the average of responses (scale: 5 = strongly agree, 4 = agree, 3 = no opinion, 2 = disagree, and 1 = strongly disagree) and the number of students responding. The numbers in brackets are the responses from alumni who graduated more than 3 years prior to the survey.

	2008		**2009**		**2011**		**2012**		*Avg.*
		N		N		N		N	
EP 1 Skills	4.5 (4.0)	4 (1)	4.1 (4.5)	7 (4)	3.0 (4.0)	2 (1)	4.4 (4.3)	5 (4)	***4.2 (4.3)***
EP 2 Career Prep.	4.5 (5.0)	4 (1)	4.0 (4.8)	7 (4)	2.5 (3.0)	2 (1)	3.8 (3.8)	5 (4)	***3.9 (4.2)***
EP 3 Prof. Adapt.	4.5 (5.0)	4 (1)	5.0 (5.0)	7 (4)	4.5 (5.0)	2 (1)	3.8 (4.0)	5 (4)	***4.5 (4.6)***
EP 4 Ethics	3.8 (3.0)	4 (1)	4.1 (4.0)	7 (4)	3.5 (4.0)	2 (1)	3.6 (3.5)	5 (4)	***3.8 (3.5)***

Faculty Input

The Department of Physics and the participating Engineering Departments have very diverse faculties, many of whom have collaborations and other interaction with potential future employers of our Engineering Physics graduates (see *Criterion 6 – Faculty*). Subsequently, many of the faculty members are well equipped judging whether our students are indeed adequately prepared, and the Engineering Physics Program Committee continuously seeks faculty input.

1. The Department of Physics holds a number of regular meetings, during which there may be discussion of issues related to EP *Educational Objectives*, such as
   - EP Committee meetings,
   - regular faculty meetings,
   - student assessment meetings,
   - faculty retreats.

2. In the Department of Physics, Engineering Physics Program Committee and faculty meetings are held at least once every month (or more often, if needed), student assessment meetings are held once per year and there is a faculty retreat just prior to the beginning of each semester.
3. The faculty in provides important input in the following areas related to the *Program Educational Objectives*, such as
   - help with the assessment of program outcomes and evaluate the different assessment tools,
   - point out weaknesses or areas of concern and suggest ways to address them,
   - evaluate the appropriateness of *Program Educational Objectives*.
4. While the faculty members provide quantitative outcomes measures (see section *4B. Program Outcomes),* their contributions to *Program Educational Objectives* are mostly qualitative (for example, anecdotal information). Even so, such information has had some impact on the way the program is administered.
5. The Department of Physics keeps electronic copies of all meeting minutes.

Input from the External Advisory Board

As outlined in *Criterion 2- Educational Objectives*, the External Advisory Board has members from all major constituencies of the Engineering Physics program. Therefore, the role of the board on the EP program in general cannot be overstated. Recommendations and advice of the board in any area is always be taken very seriously by the Department of Physics and the Engineering Physics Program Committee.

1. The board's main tasks are to evaluate the quality of the program and identify areas of opportunity or improvement. The board also provides indispensable feedback about the choice and level of attainment of the *Program Educational Objectives*
2. Except for 2010 (when the Department of Physics was displaced from Gardiner Hall), the department has held External Advisory Board meeting each year since 2007.
3. All of the past External Advisory boards provided increasingly positive feedback about the program's progress overall and in achieving its *Educational Objectives*. The most recent board meeting (2011/2012) also helped to re-define and re-write the *Educational Objectives*.
4. After an External Advisory Board meeting, the board provides a written report about findings and recommendations, and past boards tended to provide very detailed reports (10+ pages). In addition, the Engineering Physics Program Committee takes minutes and keeps copies of all presentations during the board meetings.
5. The Department of Physics keeps electronic copies of the External Advisory Board Reports and the meeting minutes, and hard copies are provided in the '*Black' Objectives Notebook*. Copies of the presentations given at board meetings are stored electronically/

Assessment of 'new' Program Educational Objectives

As mentioned above, the *'new' Program Educational Objectives* have been implemented just recently, and subsequently previous assessments were not geared toward these 'new' targets. However, a substantial wealth of information is found in records from past assessments as well as records about alumni, which in turn does allow to get at least some rough ideas about level of achievement for each of three *'new' Program Educational Objectives*. For future assessment purpose, we plan to utilize three major assessment tools:

- ***Alumni Surveys.***
  Regular surveys of alumni will provide the following data: 1) quantitative results about level of attainment for each individual Program Educational Objective, and 2) updated employer information and job descriptions.
- ***Input from External Advisory Board.***
  The External Advisory Board will continue to be the main assessor of the Engineering Physics program.
- ***Employer Surveys.***
  To date, we have not performed any employer surveys. We intend to contact present employers of alumni after they have been employed for more than 1 year. A survey form is presently being developed.

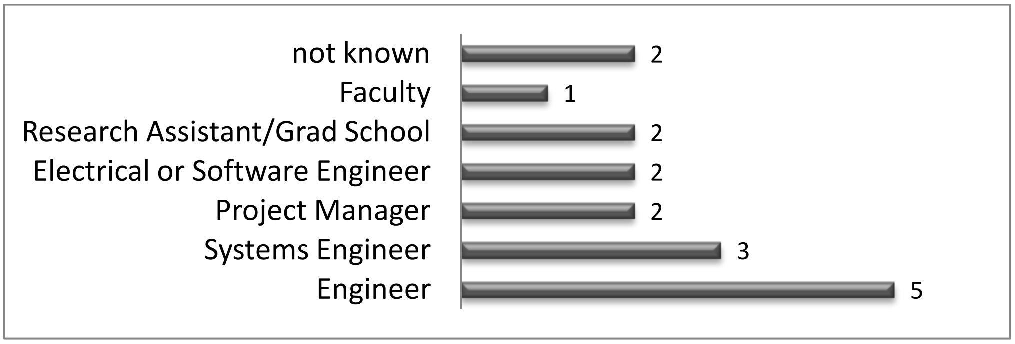
With the implementation of *'new' Program Educational Objectives*, we modified the *Alumni Survey Form to* reflect those. A copy of the most up-to-date *Alumni Survey Form* can be found at http://engineeringphysics.nmsu.edu/forms.html, and it is also provided in *Supplementary Information.*

However, even the past alumni surveys can be used to assess level of achievement for each of the *'new' Program Educational Objectives*. For example, this is clearly the case for the 'new' *EP Objective 2 – Adaptability* (as it is essentially the same as the 'old' *EP Objective 3*). It was already pointed out that also the other two 'new' objectives can be somewhat correlated to 'old' ones.

More importantly, alumni surveys also allowed keeping up-to-date employer information and current job descriptions of our alumni.

To date, the Engineering Physics program graduated 19 students. Two of those students graduated in the most recent semester (Spring 2012) at the time this document was written (one in Engineering Physics with the *Mechanical concentration* and the other with the *Aerospace concentration*) and they just started looking for jobs. A recent survey revealed that our Engineering Physics alumni are recruited for diverse jobs in science and engineering, and they are frequently hired for well-paid and high-level positions, as evidenced by the job titles given in Diagram 4.1. This provides evidence that the 'new' *EP Objective 1- Competitiveness* is achieved. In addition, all alumni indicated that they work as part of teams and three of the alumni indicated that they are leaders of a major project. This can be taken as evidence that the 'new' *EP Objective 3- Teamwork and Leadership* is achieved.

Diagram 4.1. Job titles of Engineering Physics alumni who graduated prior to Spring 2012.

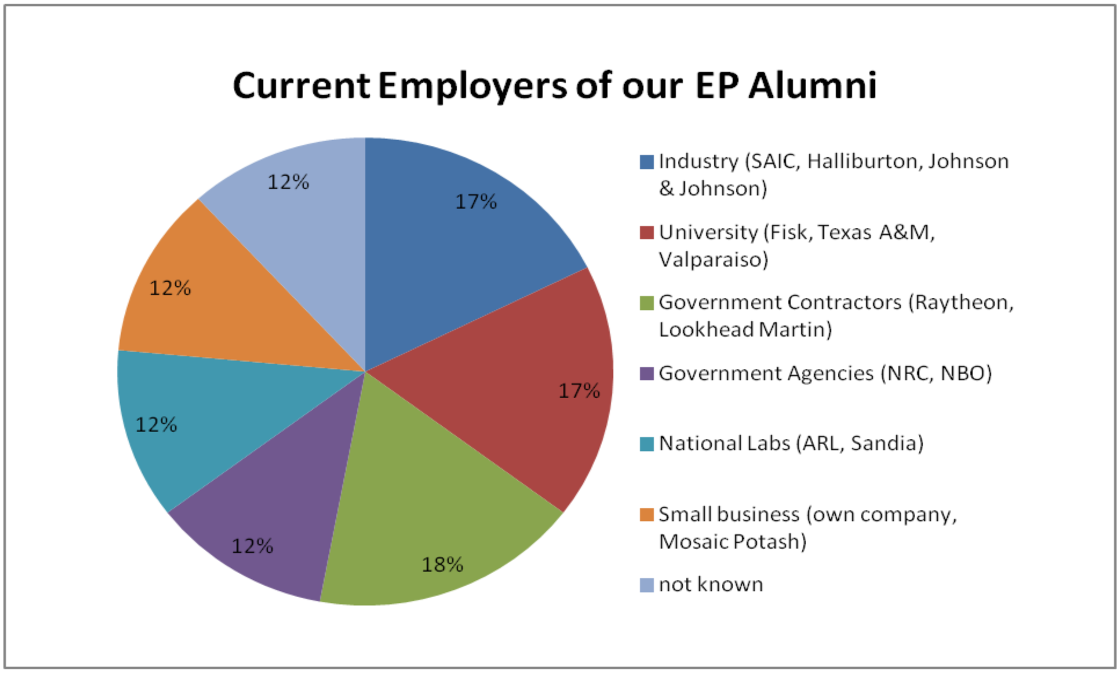


The alumni surveys also provide up-to-date employer information. Of the 17 alumni prior to Spring 2011, 7 have completed (or are pursuing) advanced graduate degrees (1 PhD in Physics, 1 PhD in Nuclear Engineering, 1 MS in Physics, 2 MS in Electrical Engineering, 1 PhD student in Physics, 1 PhD student in Mechanical Engineering) and another 7 found employment with industry, small business, government agencies or national laboratories (see Diagram 4.2). The diagram provides ample evidence that our Engineering Physics alumni are clearly competitive and that they find employment in many different research and technological areas, which gives further evidence that 'new' objectives *EP 1 – Competitiveness* and *EP 2 – Adaptability* are attained.

In addition to the more formal alumni surveys, the Department of Physics tries to connect with alumni in person, whenever possible. Alumni are invited to the departmental picnics and on occasion faculty members or the department head set up meetings with alumni when they happen to visit locations near an alumni's new affiliation. These meeting provide important anecdotal information. As an example, Dr. Zollner (Physics Department Head) met with one of our early alumni recently, and below is the report of his interaction with the alumni:

In June 2012, the Physics Department Head visited one of the earliest alumni of the program, who graduated in the spring 2005 semester. The alumnus has worked for several companies over the years and has been very successful. Currently, he works as a civilian at a Navy Air Base in Southern Maryland. His job responsibility addresses electromagnetic effects on Navy aircraft. The alumnus provides specifications to air craft suppliers and works with suppliers during the R&D process to make sure the specifications are met. When manufacturing is completed, the alumnus performs extensive tests, before the new air craft is released to the squadron. The test facilities for these air craft are quite impressive. The alumnus does not have direct reports, but has access to a technician pool for his work. The alumnus seemed very happy in his current position. He holds a civilian rank in the Navy equivalent to Lieutenant Commander. He is interested in rising to a higher position in the Navy, but this will take some time. He is interested in a technical MS degree, but it would have to be mostly online. Unlike engineers, who follow prescribed paths towards resolving technical problems, our engineering physics alumnus says that he tries to understand WHY something does not work and follows a less structured approach towards problem resolution. This sometimes works better than a canned solution. The alumnus offered a suggestion for a capstone project on electromagnetic effects (paper shredder *and cathode ray tube television) and said he was willing to provide his experience, advice, and guidance to students on such a project.*

Diagram 4.2. Employers of NMSU's Engineering Physics alumni who graduated prior to Spring 2012.



B. Student Outcomes

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

1. *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.*
2. *The frequency with which these assessment processes are carried out*
3. *The expected level of attainment for each of the student outcomes*
4. *Summaries of the results of the evaluation process and an analysis illustrating the extent to which each of the student outcomes is being attained*
5. *How the results are documented and maintained*

While the *Senior Exit Interviews* (discussed in the previous section) provide some rough ideas about the level of achievement for different program outcomes, those are primarily at the course level (see *Criterion 3 – Program Outcom*es). Each course instructor knows which program outcomes are assigned to be measured in that course. They are then asked to design a quantitative measure for each program outcome, if none exists. Instructors' results are documented in the Instructors Notebooks each time the course is taught. In 2008, we started a process where individual faculty members are asked to summarize the findings for one particular outcome. That way we made sure that all faculty members are not only aware but also involved in the assessment process. The summaries are collected annually and documented in the *Program Outcomes Notebook*. An example of an Outcomes Assessment is provided in *Supplementary Information.*

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

Below, we summarized the results for each of the program outcomes, which were measured as part of the Engineering Physics program.

Program Outcome (a) - Scientific Expertise

1. This program outcome was assessed using the national *Force Concept Inventory* test (Hestenes, Wells, and Swackhamer, 1992; Hestenes, D., and I. Halloun, 1995), final exam results, embedded questions, *Mastering Physics®* skill building problems, and final exam results. In addition, the *Educational Testing Service (ETS) Physics Major Field Test* was administered in Spring 2012. The *ETS* has two sections, and the introductory section was used to assess *Program Outcome (a)*.
2. Typically, data are collected in relevant classes each time they are taught, i.e. *Physics 213*, *214*, *215*, *216*, and *217*.
3. The target level is set by instructor depending on method used. Occasionally, instructors used nationally administered tests, in which case the national norm was used to define the target. For example, some instructors used the *Force Concept Inventory*, which was given at the beginning and end of the class in order to gauge improvement. The target level was set at 48% by the instructor based on national expectations for a course using a traditional-instruction approach; for an active-learning based course, the national average is 23%. The target for the *ETS Physics Major Field Test* was set at 50% as rated nationally.
4. The results are displayed in Diagram 4.3.a. All of the measurements indicate that the level of achievement is between 80% and 110% of target. *Program Outcome (a)* is one of the more straightforward measures for a program in physics or engineering physics. courses,. On the *ETS Physics Major Field Test* introductory section, the median student was the 47th percentile, slightly below national target.
5. Results are documented in the *Instructors Notebooks* for relevant classes and summarized in the *Program Outcomes Notebook*.

Program Outcome (b) - Experimental Training

1. This program outcome was assessed using final exam grades, laboratory homework, embedded final exam questions, and individual lab reports.

2. Data were collected in relevant classes each time they are taught, i.e. *Physics 213L*, *214L*, *215L*, *216L*, *217L*, and *475*.
3. The target level is set by instructor depending on method used. In many cases, the departmental average or the B grade value, and several instructors used this as the target value. In other cases, however, the instructor set the standard based on their expectations.
4. The results are shown in Diagram 4.3.b, and it is apparent that almost all results are near the target levels.
5. Results are documented in the *Instructors Notebooks* for relevant classes and summarized in the *Program Outcomes Notebook*.

<u>Program Outcome (c) - Design Abilities</u>

1. This program outcome was assessed using students' *Experimental Design Reports* (*Physics 315L*) and instructor's observations during the assembly of a muon-decay experiment.
2. We expected data to be collected in relevant classes each time they were taught, i.e. Physics *315L*, *471*, *475*, and *476*.
3. The target was set by instructors who measured this outcome at 80%.
4. As can be seen in Diagram 4.3.c, unfortunately only two courses were able to report results for this particular outcome. The few available results were near target level. *Physics 471 - Experimental Optics* was not offered since 2006 because the instructor of that course retired. *Physics 476 - Computational Physics*, a possible EP elective, is cross-listed with the graduate *Physics 576*, and it too little undergraduate enrollment in order to do a meaningful assessment. In order to boost the number of assessments for this particular outcome in future assessment, the Engineering Physics Program Committee decided to add this outcome to the list of expected measures in *Physics 217L - Heat Light and Sound Lab*.
5. Results are documented in the *Instructors Notebooks* for relevant classes and summarized in the *Program Outcomes Notebook*.

<u>Program Outcome (d) - Teamwork</u>

1. This program outcome was typically assessed *Peer Team Evaluations* in laboratory courses. Students ranked contributions and participation of their peers on a scale of 1-4.
2. We expected data to be collected in assigned classes each time they were taught, i.e. *Physics 315L*, *471L*, and *475*.
3. The targets were set by the instructors.
4. As can be seen in Diagram 4.3.d, the targets were generally met. The students usually get along well, even there is the occasional problem student. *Physics 471L- Optics Lab* was last taught in Spring 2008 and it will be taught again in Fall 2012. In future assessments, *Physics 217L - Heat, Light and Sound Lab* will provide an additional measurement for this outcome.
5. Results are documented in the *Instructors Notebooks* for relevant classes and summarized in the *Program Outcomes Notebook*.

<u>Program Outcome (e) - Problem Solving</u>

1. This program outcome was assessed almost entirely by using *Graduate Record Exam (GRE)* questions inserted into quizzes and tests. In Physics 451, Fall 2011, this was supplemented by using the *Force Concept Inventory* test. Moreover, in Spring of 2012, the *Educational*

Testing Service (ETS) Physics Major Field Test was administered. It has two sections, and the advanced section was used to assess *Program Outcome (e)*.

2. Data are collected in assigned classes each time they are taught, i.e. *Physics 451*, *454*, *455*, *461*, *462*, and *480*.
3. All 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. For the *Force Concept Inventory* the level was set at 85%, which is considered the Newtonian Mastery level. The *ETS Physics Major Field Test* target was set at the 50^{th} percentile for the advanced physics section
4. As can be seen in diagram 4.3.e., using *GRE* questions, targets were typically met and often exceeded. Most students met the Newtonian Mastery level on the Force Concept Inventory test, although a few students scored well below it. On the *ETS Physics Major Field Test* the median student score was at the 68^{th} percentile, again well above the target.
5. Results are documented in the *Instructors Notebooks* for relevant classes and summarized in the *Program Outcomes Notebook*.

<u>Program Outcome (f) - Professional Responsibility</u>

1. Assessment of this program outcome was done using essays and/or student use of citations in essays, although other measures were used as well. For example, in *Physics 473*, homework completion rate and in-class worksheet completion rate were used (percent of homework and worksheets completed by students). This indicates if the students were being responsible for homework completion and class attendance.
2. This outcome is measured each time a relevant course is taught, i.e. *Physics 315*, *315L*, *470*, *471*, *473*, *475*, *488*, and *489*.
3. Targets were set by individual instructors of each course.
4. As can be seen in diagram 4.3.f, the targets were typically met. *Physics 470 - Physical Optics* and *Physics 471 - Modern Experimental Optics* are no longer part of the curriculum, and these courses have been replaced by *Physics 473*, which was first taught in Spring 2012.
5. Results are documented in the *Instructors Notebooks* for relevant classes and summarized in the *Program Outcomes Notebook*.

<u>Program Outcome (g) - Communication Skills</u>

1. Assessment of this program outcome was done using written reports in lab courses with an emphasis on writing quality and grammar, and from oral presentations.
2. We expected that this outcome would be measured each time a relevant course is taught, i.e. *Physics 315*, *471*, and *475*.
3. Targets were set by instructors.
4. As can be seen in diagram 4.3.g, students' communication skills are good. *Physics 471 - Physical Optics* is no longer part of the curriculum as the instructor has retired..
5. Results are documented in the *Instructors Notebooks* for relevant classes and summarized in the *Program Outcomes Notebook*.

Program Outcome (h) - Societal Impact

1. Assessment of the program outcome was done through essays, specific homework assignments, and class participation.
2. This outcome was measured each time relevant classes were taught: *Physics 315*, *470*, *488*, *489*, and *305V*.
3. Targets were set by the instructors.
4. As can be seen in diagram 4.3.h, targets were generally reached. *Physics 489 - Modern Materials* was particularly relevant to this outcome. *Physics 470 - Physical Optics* is no longer part of the curriculum and was not taught during this time period.
5. Results are documented in the *Instructors Notebooks* for relevant classes and summarized in the *Program Outcomes Notebook*.

Program Outcome (i) - Lifelong Learning

1. This program outcome was assessed with essays, selected homework problems, and oral presentations.
2. This outcome was measured each time the relevant classes were taught, i.e. *Physics 315*, *488*, *489*, and *305V*.
3. Targets were set by instructors.
4. As can be seen in diagram 4.3.f, targets were not met in early years, but there are indications of improvement in more recent semester.
5. Results are documented in the *Instructors Notebooks* for relevant classes and summarized in the Program Outcomes Notebook.

Program Outcome (j) - Contemporary Issues

1. Assessment of this program outcome was done using essays, often with an emphasis on the choice of presentation topic, and oral presentations.
2. This outcome was measured each time the relevant classes were taught, i.e. *Physics 315*, *470*, *488*, *489*, and *305V*.
3. Targets were set by instructors.
4. As can be seen in diagram 4.3.j, targets were generally met.
5. Results are documented in the *Instructors Notebooks* for relevant classes and summarized in the *Program Outcomes Notebook*.

Program Outcome (k) - Technical Know-how

1. Assessment of the program outcome used in-lab observations in the lab courses and exam questions or standardized questions from the *Fundamental Engineering* exam (FE).
2. This outcome was measured in lab courses each time they were taught, i.e. *Physics 315L*, *471*, *475*, *476*, and *495*.
3. Targets were set by instructors.
4. As can be seen in diagram 4.3.k, targets were generally met.
5. Results are documented in the *Instructors Notebooks* for relevant classes and summarized in the *Program Outcomes Notebook*.

Below, we display the Diagrams 4.3.a-k, which summarize the results discussed above.

Diagram 4.3.a. Measured level of achievement (normalized to the stated target) of all courses for *Program Outcome (a)* since Fall of 2006.

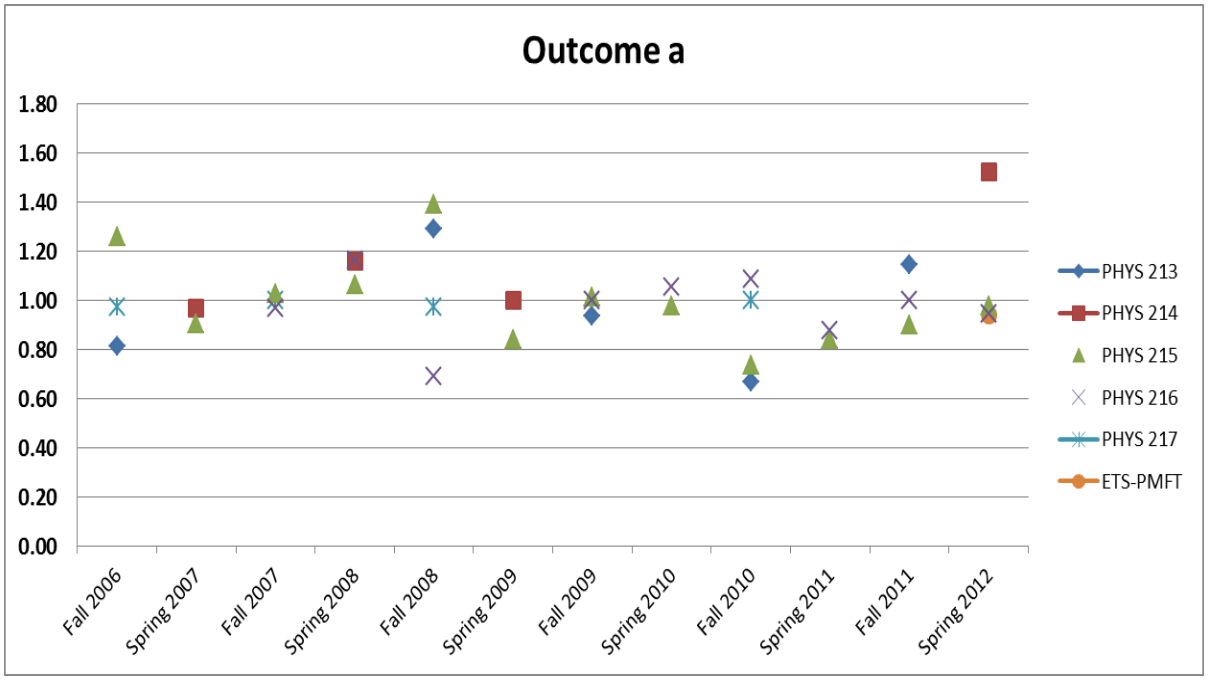


Diagram 4.3.b. Measured level of achievement (normalized to the stated target) of all courses for *Program Outcome (b)* since Fall of 2006.

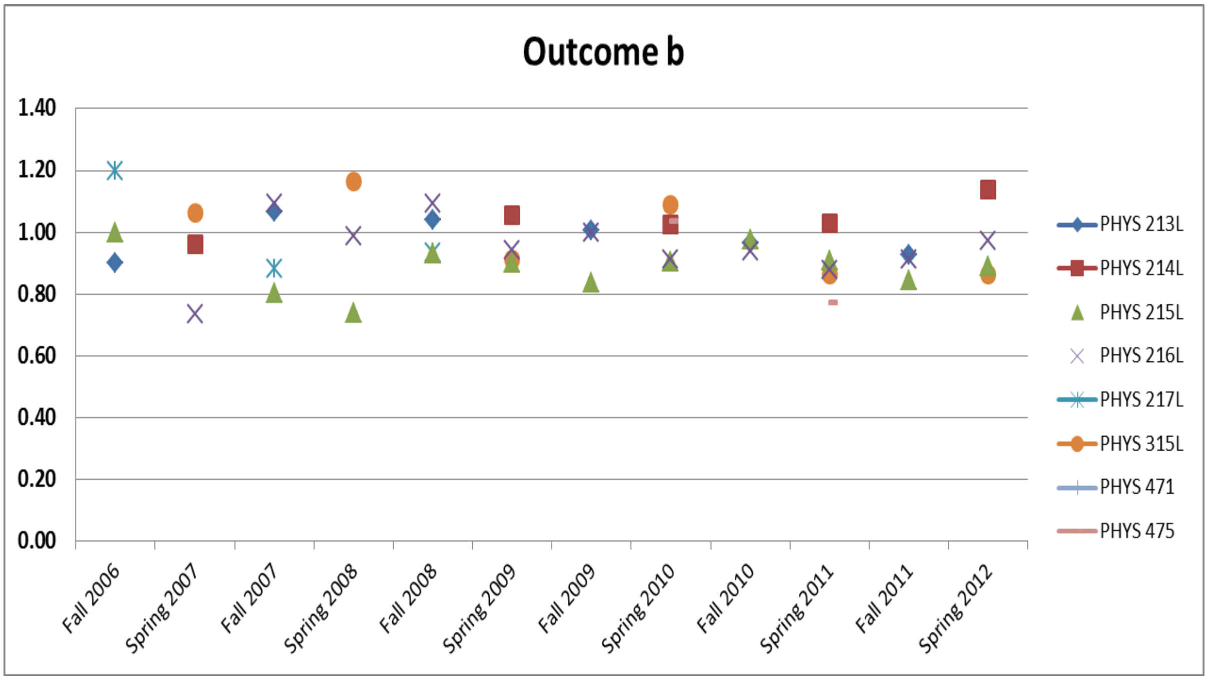


Diagram 4.3.c. Measured level of achievement (normalized to the stated target) of all courses for *Program Outcome (c)* since Fall of 2006.

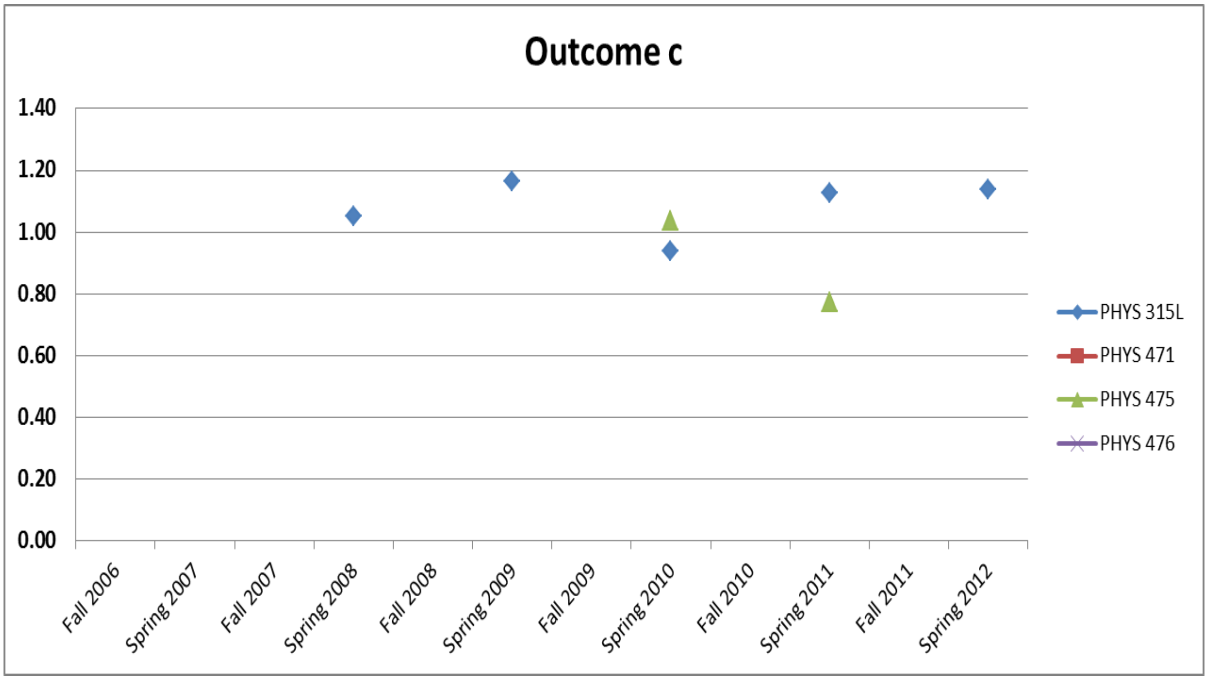


Diagram 4.3.d. Measured level of achievement (normalized to the stated target) of all courses for *Program Outcome (d)* since Fall of 2006.

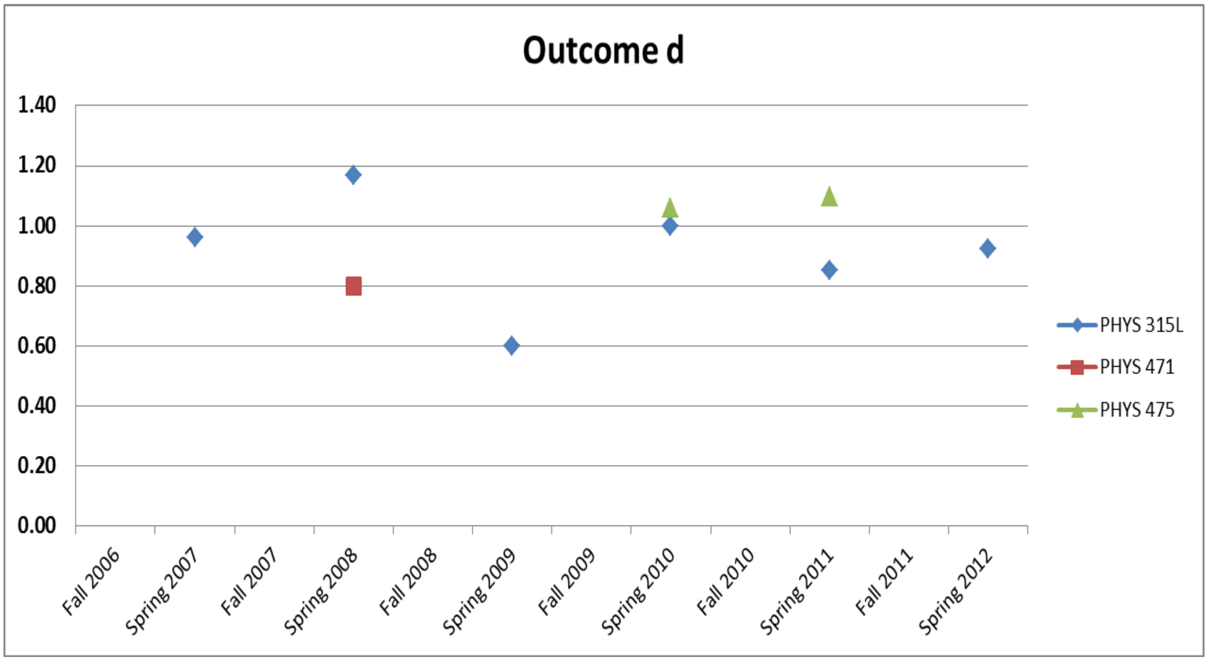


Diagram 4.3.e. Measured level of achievement (normalized to the stated target) of all courses (and other measures) for *Program Outcome (e)* since Fall of 2006.

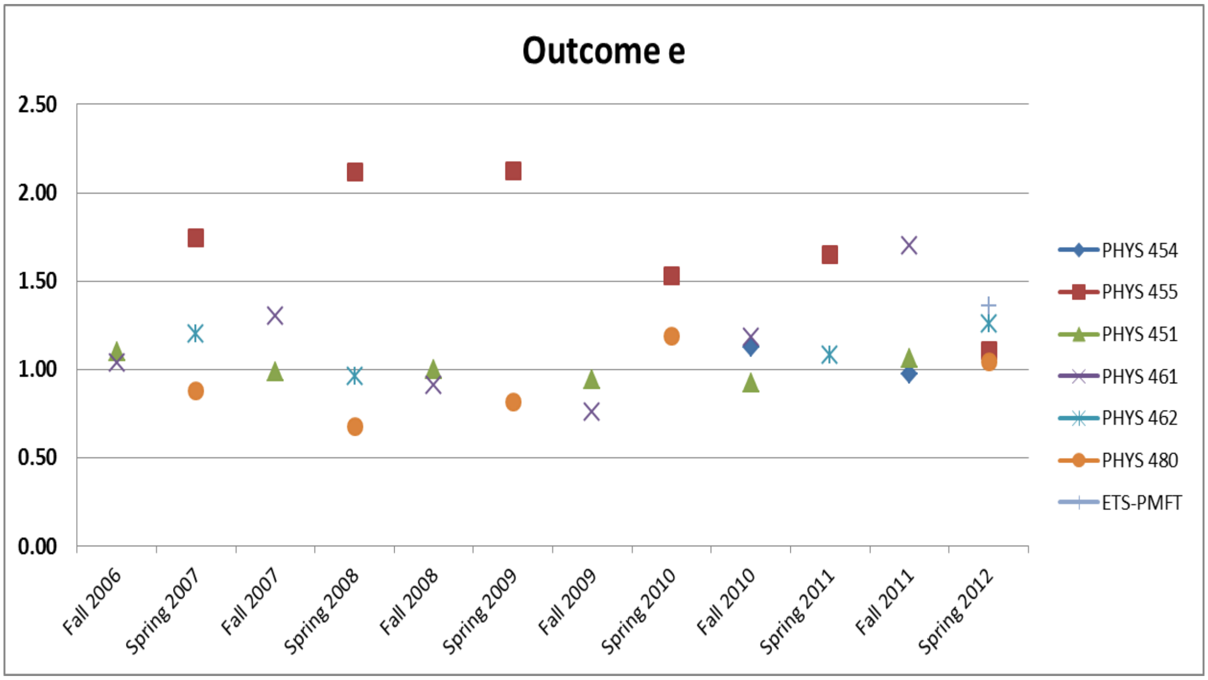


Diagram 4.3.f. Measured level of achievement (normalized to the stated target) of all courses for *Program Outcome (f)* since Fall of 2006.

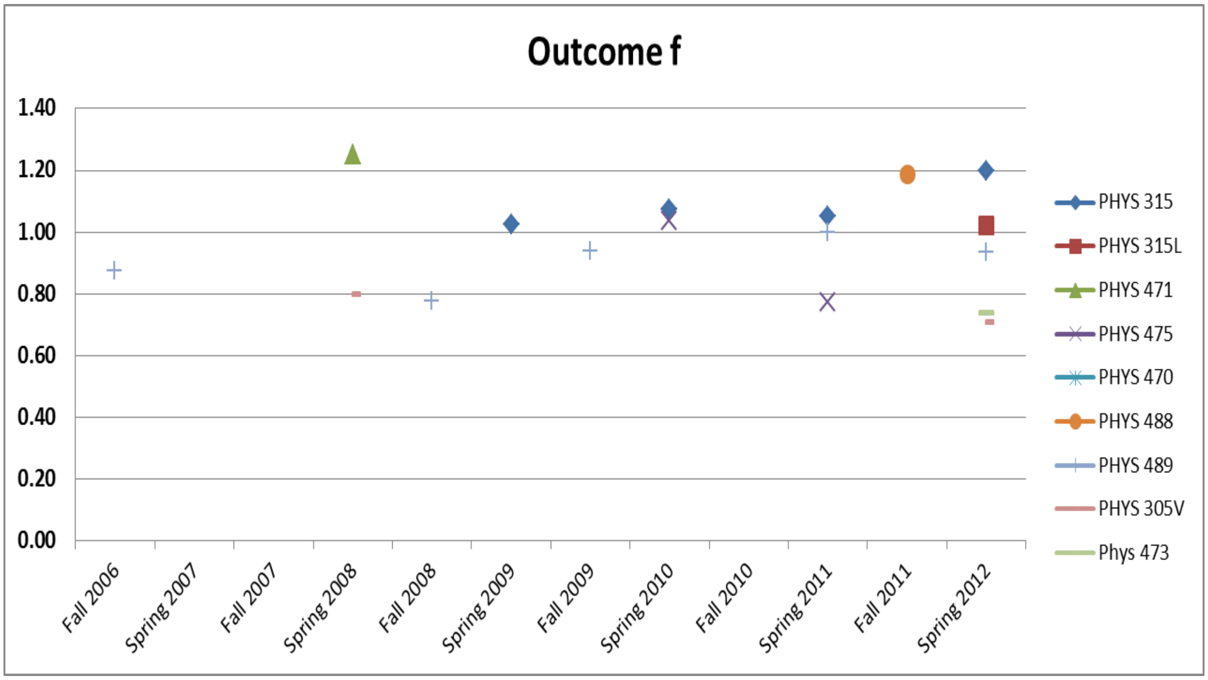


Diagram 4.3.g. Measured level of achievement (normalized to the stated target) of all courses for *Program Outcome (g)* since Fall of 2006.

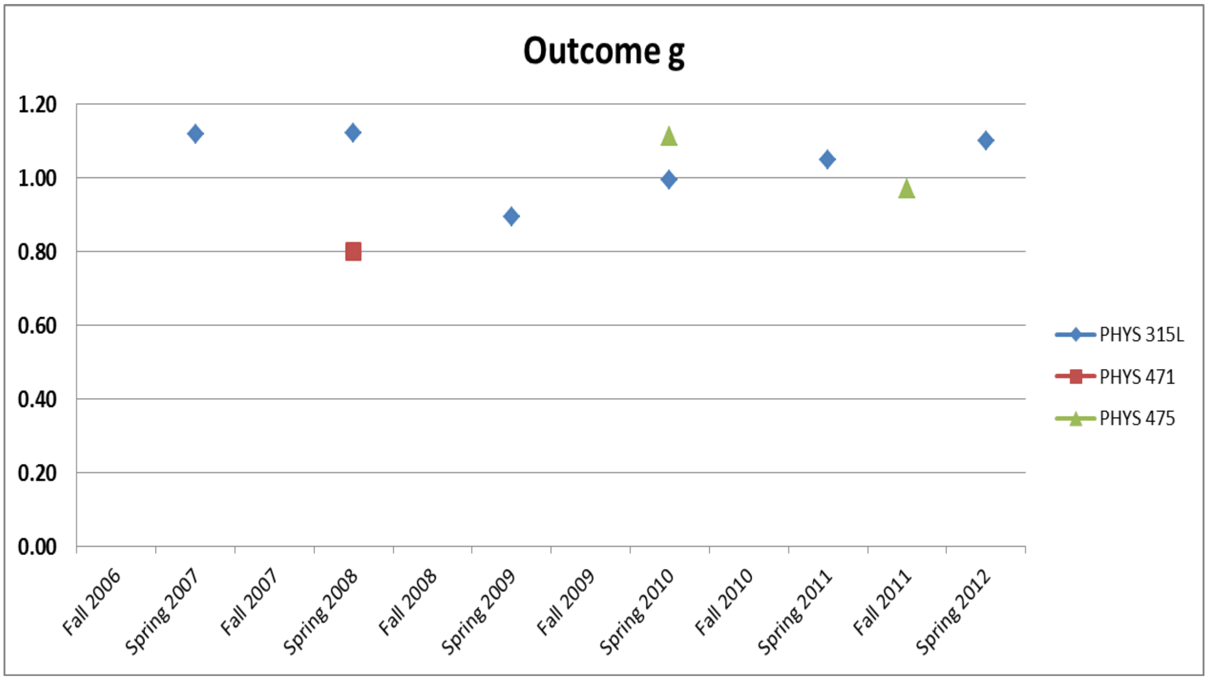


Diagram 4.3.h. Measured level of achievement (normalized to the stated target) of all courses for *Program Outcome (h)* since Fall of 2006.

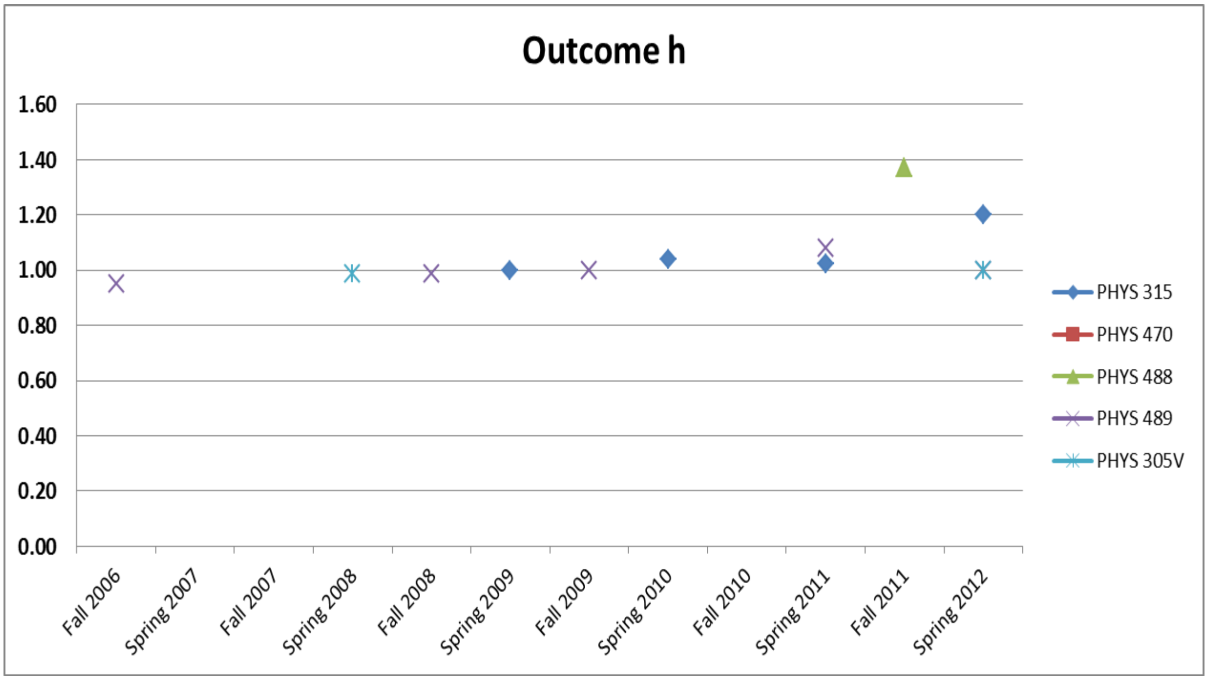


Diagram 4.3.i. Measured level of achievement (normalized to the stated target) of all courses for *Program Outcome (i)* since Fall of 2006.

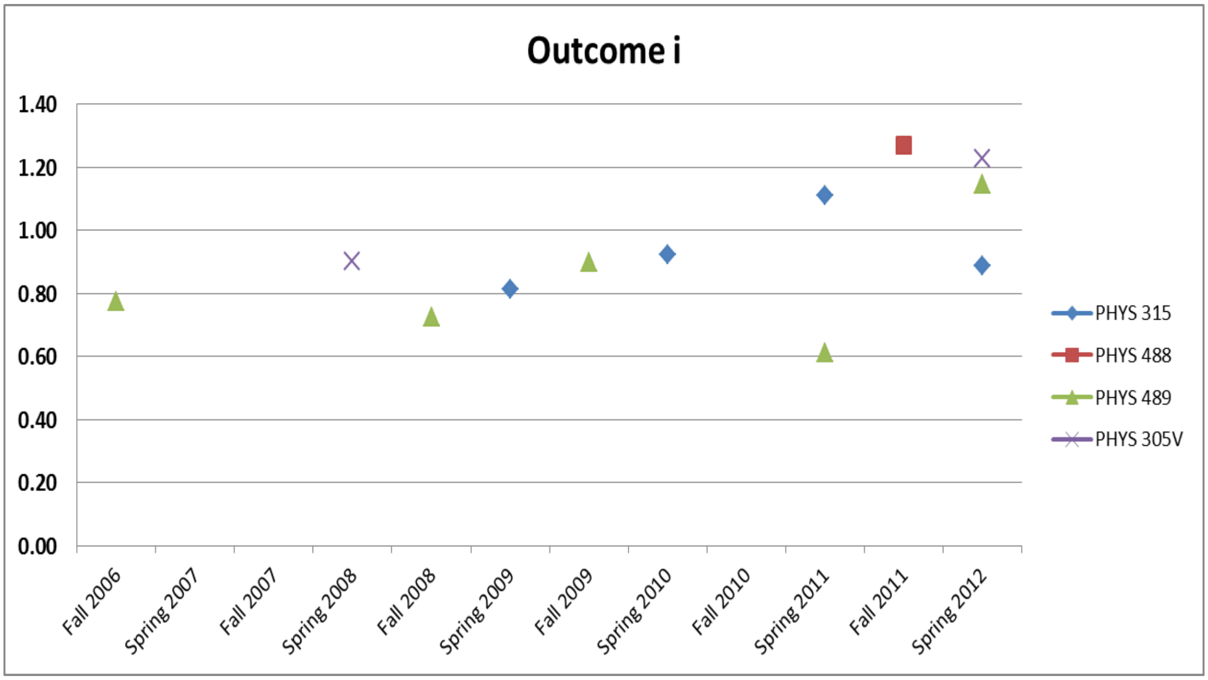


Diagram 4.3.j. Measured level of achievement (normalized to the stated target) of all courses for *Program Outcome (j)* since Fall of 2006.

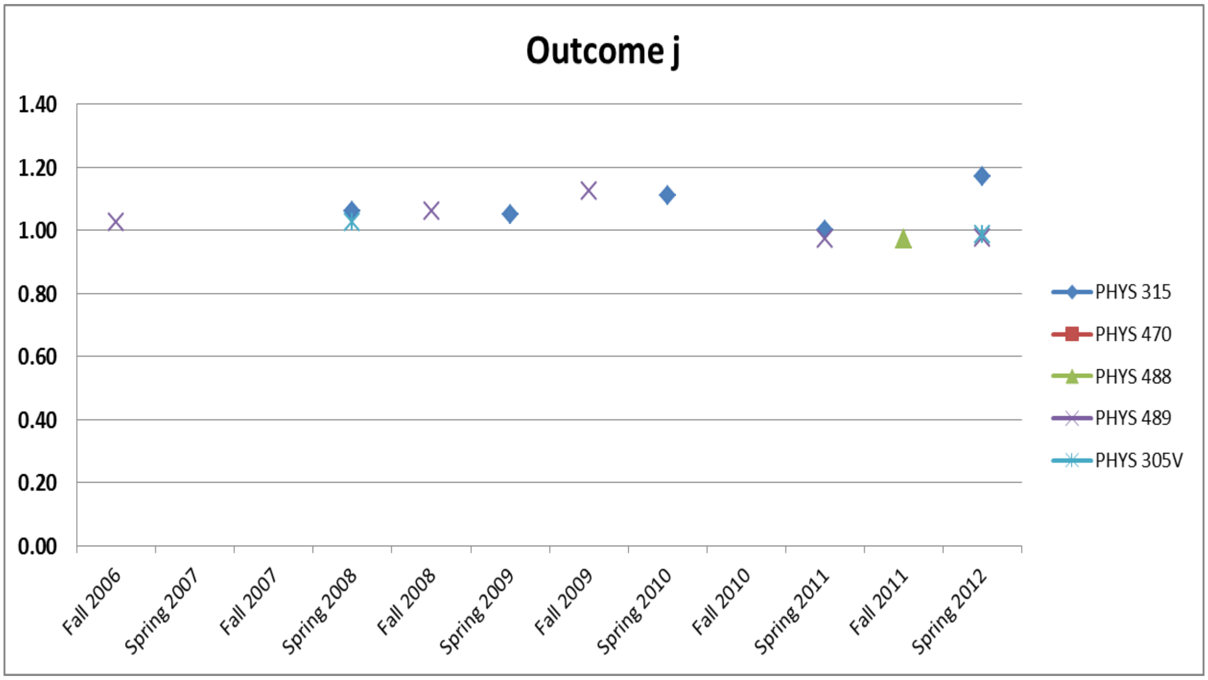
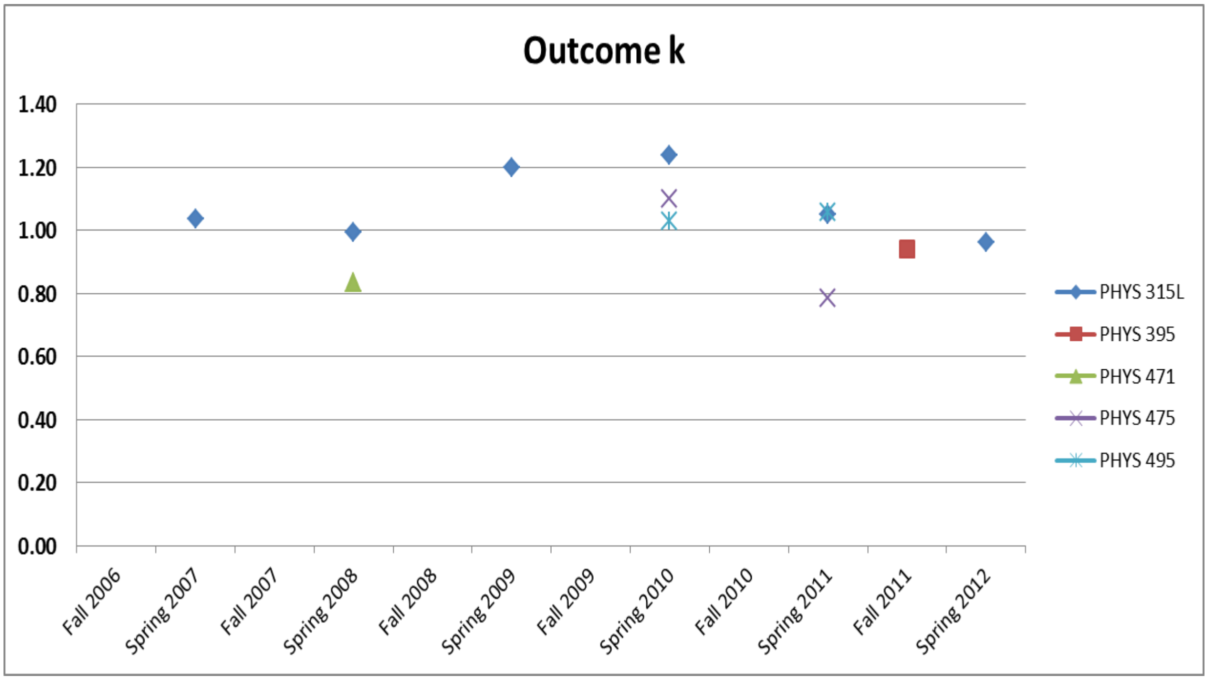


Diagram 4.3.k. Measured level of achievement (normalized to the stated target) of all courses for *Program Outcome (k)* since Fall of 2006



In principle, several of above program outcomes, i.e. *(f) - Professional Responsibilities*, *(g)- Communication Skills*, *(h) -Societal Impact*, and *(j) - Contemporary Issues*, are also addressed by classes that are part of the New Mexico State Common Core. The State Common Core is extensive and explicitly requires courses in Communications (9 credits), Social and Behavioral Sciences (6-9 credits), and Humanities and the Fine Arts (6-9 credits). All Common Core courses are being assessed on a regular basis as part of the State Common Core program.

C. Continuous Improvement

Describe how the results of evaluation processes for the program educational objectives and the student outcomes and any other available information have been used as input in the continuous improvement of the program. Indicate any significant future program improvement plans based upon recent evaluations. *Provide* a brief rationale for each of these planned changes.

Continuous improvement has occurred primarily as a result of faculty meetings, Engineering Physics Program Committee meetings, faculty review meetings, and Engineering Physics External Advisory Board meetings. In this section, we discuss the various changes in the program that have been made to correct deficiencies in our outcomes and objectives (closed loops). The closed loops are given in random order, not necessarily in sequence of importance.

Introduction of *Physics 395 - Intermediate Mathematical Methods* to replace *Physics 495 - Mathematical Methods* - addresses *Program Outcomes (a)* and *(e)*

a. *This deficiency was identified by instructors in upper division classes. It was discussed in the 2007, 2009, 2011 faculty retreats.*
b. *The first two years of physics, while highly mathematical, focus primarily on the physical concepts. In more advanced classes, however, students often find a leap in the*

mathematical levels of classes; furthermore, they are often introduced to mathematical concepts that are not taught in the standard series of required math classes. For example Fourier Transforms, complex variables, Taylor Series, and tensors are not covered in the math classes. Our previous course in Mathematical Methods, Physics 495, was not taken by students until their senior year and could not be applied to earlier classes.

c. *Physics 395, Intermediate Mathematical Methods, is now required of all Engineering Physics majors and should be taken by students at the end of their second year or beginning of their third year so that this knowledge can be applied to future courses.*
d. *Change implemented in Fall 2011. PHYS 395 is now required for all Engineering Physics majors. Engineering Physics curricula and associated flowcharts were also adjusted*.

New textbook for *Physics 213, 214, 215, 216, 217 and 315* – addresses *Program Outcomes (a)* and *(e)*

a. *Instructors were disappointed with the previous textbook, Knight, Physics for Scientists and Engineers and this was first brought up at the 2007 faculty retreat. Student evaluations of this book were dismal.*
b. *The Knight textbook was adopted in 2005 after careful review by faculty that included outside recommendations. It was written by a leading expert in educational physics. Nevertheless, faculty complaints began immediately. Several key subjects were missing and subject order was confusing. Student evaluations of this book are the worst on record.*
c. *Physics adopted the book by Young & Freedman, University Physics. This is one of the most widely used textbooks for calculus based physics. The book is working out well.*
d. *Change adopted in 2007.*

***Physics 216L* - Introduction of more Hands-on Labs** – addresses *Program Outcome (b)*

a. *This weakness was identified in the 2009 faculty retreat,*
b. *Currently, we use the text "McDermott & Schaffer, Tutorials in Introductory Physics". Several of the Electricity & Magnetism Labs required only pencil and paper, no real equipment. These make for great tutorials, but do not constitute proper laboratory instruction. The Department of Physics has equipment, and this makes our programs better than many, especially on-line programs. We need to take advantage of this strength.*
c. *Pencil and paper labs from this book have been reduced and replaced by other labs in the book that use real wires, batteries, and magnets.*
d. *Dr. Steve Kanim (whose research is in Physics Education research) was charged with implementing changes to the labs. Those began in late 2007 and additional modifications are still continuing.*

Introduction of *Physics 280 - Supplementary Instruction* for *Physics 213* – addresses *Program Outcome (a)*

a. *This need was identified in Spring 2011 Faculty Program Outcome review.*
b. *Students were getting worse on the Force Concept Inventory exam despite the introduction of active teaching methods. They needed more problem solving practice (outcome e).*
c. *Physics 280, Supplementary Instruction for Physics 213 (1 credit) was introduced.*
d. *This one credit course will be first taught in Fall 2012.*

Teaching Assistant (TA) Teaming for introductory labs - addresses *Program Outcome (b)*
a. *Identified in Spring 2011 Faculty Program Outcomes meeting.*
b. *There were too many inexperienced TAs for introductory labs and more experienced TAs were not available.*
c. *Inexperienced TAs were teamed with experienced TAs.*
d. *Introduced Spring 2011.*

Teaching Assistant assigned for *Physics 315L* - addresses *Program Outcomes (b)*, *(f)*, *(g)* and *(k)*
a. *Identified Spring 2011 Faculty Program Outcome review.*
b. *The 315L instructor simply could not supervise simultaneous experiments effectively. This is an advanced laboratory and requires more detailed supervision from faculty.*
c. *TA was assigned to this laboratory*
d. *Implemented Spring 2011.*

Improved apparatus and a grading rubric were introduced for Physics 315L - addresses *Program Outcomes (b)*, *(g)* and *(h)*
a. *Identified Spring 2011 Faculty Program Outcome review.*
b. *The equipment was old. The introduction of written and oral reports on outcomes g, communication, and h, societal impact required new grading schemes.*
c. *Improved apparatus and a grading rubric for oral and written reports were introduced for Physics 315L.*
d. *Implemented Spring 2011.*

Introduction of Educational Testing Service – Physics Major Field Test - addresses *Program Outcomes (a)* and *(e)*
a. *Identified in Spring 2011 by the Department Head as a good way to test our outcomes.*
b. *Currently, outcomes a, scientific expertise, and b, problem solving, rely on embedded questions in tests and the Force Concept Inventory exam. Physics has used Graduate Record Exam (GRE) questions for many of the embedded questions and compared them to national scores. However, the testing environment is not the same and questions are picked according to what is covered in class. It is feared that this leads to unrealistic targets.*
c. *The ETS – Physics Major Field Fest was implemented. This is a commercial test with national-norm scores. Part 1 of the test is the introductory section and is used to assess outcome a; part 2 of the test is the advanced section and is used to assess outcome e.*
d. *Implemented Spring 2012.*

Introduction of new Program Educational Objectives for ABET 2012 – addresses *Program Educational Objectives*
a. *Initiated at 2012 Fall Engineering Physics Advisory Board meeting.*
b. *ABET 2012 requires that the objectives be more specifically related to information from students who have already graduated, and not simply a remapping of ABET outcomes.*
c. *Three new ABET objectives were designed by the advisory board to replace the old ones.*
d. *Implemented Spring 2011 for preparation for ABET 2012.*

Creation of *Student Engineering Physics Society (SEPh)* – indirectly addresses *Program Educational Objectives*
a. *Recommendation of the Engineering Physics External Advisory Board (EPAB) in 2010*

b. *The EPAB recommends that the Society of Physics Students (SPS) be resurrected and provided dedicated space within the department for study groups. Engineering Physics students should be encouraged to become fully enabled members and, if appropriate, leaders of this society. The sense of community and department identification is expected to improve the program, for example, in retention. A larger, more vital SPS is in the department's interests, as well.*
c. *The Department has always run a branch of the Student Physics Society with associated space. Although Engineering Physics Student had been part of this, it was recognized that they need their own identity. Thus the Student Engineering Physics Society was born. Although this group continues to work with the Student Physics Society, they also have independent meetings and a separate advisor (Dr. DeAntonio).*
d. *SEPh was formed in 2010 and it is now an officially registered organization.*

Improve Student Retention – indirectly addresses *Program Outcome (g)*

a. *Recommended by Engineering Physics Advisory Board (EPAB) in 2010*
b. *The EPAB recommends that the Department of Physics take measures to produce a home department identity for the Engineering Physics students. Providing dedicated space for Engineering Physics students will help this situation by improving peer support. This space must be in the Department of Physics, because of the diversity of the partnering engineering departments. Additional measures could include Society of Physics Students involvement, informal monthly meetings (e.g., lunches) for students and faculty, departmental colloquia, etc. Participation should be open to include all students of the department, so that Engineering Physics students identify with all who have parallel interests and concerns.*
c. *In the past six years the Department moved out of Gardiner Hall for two years while it was renovated, only to return to a building that was shared with another department. Every administrative post from Department Head to President has seen at least two changes during this period. These changes have been very demoralizing for both the department and the University. The Department now has a department head, dean, provost and president that have lasted more than two years. It is hoped that this trend of stability at NMSU continues.*
d. *Our current department head has lasted two full years, so have the deans, provost and president.*

Own Capstone Projects for Engineering Physics Students – addresses *Program Outcomes (c)* and *(k)*

a. *Recommended by Engineering Physics Advisory Board 2010*
b. *The department has relied heavily on capstone projects in the associated department of Electrical Engineering, Mechanical Engineering, and Aerospace Engineering. (Chemical Engineering does not have capstone courses). However, this does not help the identity of the Engineering Physics program and internal capstone projects are needed. This has been difficult due to the minimum enrollment requirements of the university.*
c. *For example, in spring 2012 Dr. Kane ran a capstone project course with four students in it. The student developed new physics demonstration equipment for the department.*

d. *The most capstone project course with Dr. Kane was successful, and it established capstone reporting requirements for the department. We look forward to developing future capstone projects as the Engineering Physics enrollment increases.*

Modifications of Course Structure and Content Delivery for Engineering Courses – indirectly addresses all of the programs outcomes, but *Program Outcomes (a)*, *(c)* and *(k)* in particular

a. *Identified by participating engineering departments (particularly, Electrical Engineering)*
b. *The participating engineering departments identified the need to modify the courses and content delivery to better serve their own majors.*
c. *While the Engineering Physics Program Committee had only marginal input into the re-design of the course structure and curricula of the engineering majors, the changes affected Engineering Physics students with concentrations in particular engineering departments. This led to a (sometimes substantial) re-design of the engineering portion of the Engineering Physics program*
d. *Implementations of subsequent changes were initiated in 2009 and were essentially completed in 2011.*

Reduction of Course Load – indirectly affects all of the program outcomes, but *Program Outcomes (f)*, *(h)*, *(i)* and *(j)* in particular.

a. *The University discontinued the 9-credit rule as an option to replace one of the Viewing-the-Wider-World (VWW) course requirements starting with the 2011/12 catalog.*
b. *The Engineering Physics Program Committee felt the strong need to address this effective increase in total credit hours, such that the program does not lead to an excessive amount of total credit hours required for the program.*
c. *The Engineering Physics Program Committee removed the following requirements as a response: Engineering Physics students with the Aerospace concentrations are no longer required to take PHYS475 – Advanced Physics Laboratory (they already take a great number of other labs as part of their curriculum), the ones with the Chemical concentration are no longer required to take Chemistry 371 – Analytical Chemistry (this had also been abandoned for the Chemical Engineering majors), the ones with the Electrical and Mechanical concentrations will take one fewer technical electives*
d. *Changes were implemented in 2012, and they will appear in the 2012-2013 Undergraduate Catalog.*

D. Additional Information

Copies of any of the assessment instruments or materials referenced in 4.A, 4.B, or 4.C 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.

Display materials include several sets of folders and binders, all of which have been introduced already in *Criterion 2- Educational Objectives* and *Criterion 3- Program Outcomes*. There will be four different sets of binders: the instructor's, the course, the outcomes and the objectives notebooks.

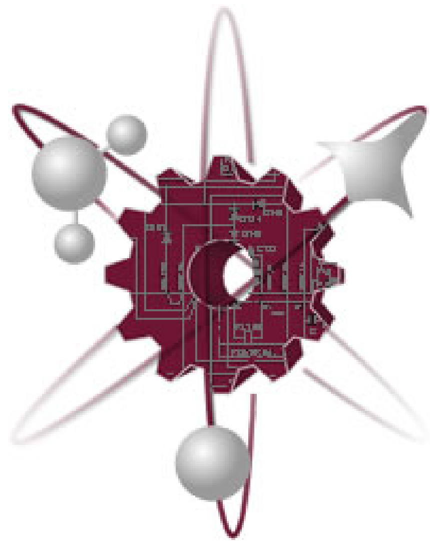
The contents of the different binders are summarized below. Textbooks, manuals and other materials are also available during the ABET review visit.

- **'Maroon' Instructor's Notebook** (prepared at the end of each course)
  - completed *Post-Course Instructor Comment Form*.
  - supporting material for Program Outcomes Assessment *(a)-(k)* (questions, tests, etc.).
  - syllabus and actual schedule followed
  - copies of exams, quizzes and homework, or references thereto.
  - copies of other class materials
- **'White' Course Notebook** (prepared for ABET review each cycle)
  - course outline and syllabus
  - copies of all assignments, i.e. pre-req. test, exams/labs/quizzes/homeworks/projects
  - exemplary copies of student work for each assignment (typically: high/medium/low)
  - hand-outs and other material used
  - summary of student evaluations
- **'Blue' Outcomes Notebook** (summarized yearly)
  - Yearly summaries of program-outcomes assessment meetings (implemented in 2008)
  - Yearly student progress reports
- **'Black' Objectives Notebook** (filled in as needed)
  - Engineering Physics Program Committee meeting minutes
  - External Advisory Board Reports and meeting minutes
  - Survey Interviews
  - Exit interviews for graduating Engineering Physics students
  - Other material (employer surveys, statistics etc.)

Criterion 5: Curriculum

Engineering Physics

Bachelor of Science in Engineering Physics



Self-Study Report

New Mexico State University

June 2012

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 average section enrollments for all courses in the program over the two years immediately preceding the visit. State whether you are on quarters or semesters and complete a separate table for each option in the program.

Compared to the 2006 Self-Study Report of NMSU's Engineering Physics program, the curriculum has considerably evolved. Since then, the Engineering Physics Program Committee added two additional concentrations, *Aerospace* and *Chemical*, in addition to the original ones, *Electrical* and *Mechanical*. Subsequently, the curricula for the *Aerospace* and the *Chemical concentrations* are presented here for the first time in an official ABET Self-Study Report. However, even for the *Electrical* and *Mechanical concentrations*, there have been some significant changes compared to the previous 2006 Self-Study Report. Some significant changes are summarized next:

As result of outcomes assessment , the Department of Physics realized that many of the students do not have solid enough upper-level Math skills when they the 400+ level physics courses. Therefore, we introduced a new course *PHYS 395 – Intermediate Mathematical Methods in Physics*, which is to be taken as a pre-requisite or co-requisite of course such as *PHYS 451, 454* or *462*. This course is now required for each of the Engineering Physics concentrations. The previously required *PHYS 495 – Mathematical Methods in Physics* is now offered as a possible elective.

The curriculum for Electrical Engineering majors underwent a major overhaul in recent years. Some courses were eliminated, others combined and new ones introduced. The changes did affect the curriculum for Engineering Physics major with the *Electrical concentration* as well.

While not as substantial as in the case of Electrical Engineering, the Mechanical & Aerospace Engineering Department also revised some portions of the curricula for their majors, particularly in the pre- and co-requisite requirements. This had some effect on Engineering Physics majors with *Aerospace* or *Mechanical concentrations*.

In order to allow for more scheduling flexibility, the participating departments agreed allowing alternate course in the other department to satisfy a particular requirement (i.e. *ME 333* or *PHYS 451*).

Discontinuation of the 9-credit rule to substitute for a *Viewing-the-Wider-World (VWW)* would have increased the number of total credit hours by another 3 credits (on top of an already high-credit degree). The Engineering Physic Program Committee therefore decided to reduce the number of technical credits required (mostly electives).

Tables 5.1.a-d provide the plan of study for each of the four Engineering Physics concentrations (in alphabetical order), namely *Aerospace*, *Chemical*, *Electrical* and *Mechanical*. NMSU operates on a semester system with spring and fall semesters of ~14 weeks of instruction each. For some of the lower-level courses students have the opportunity to make up classes during summer.

Table 5.1.a. Curriculum for Bachelor of Science in Engineering Physics – Aerospace Concentration

Course (Department, Number, Title) List all courses in the program by term starting with first term of first year and ending with the last term of the final year.	Indicate Whether Course is Required, Elective, or a Selective Elective by an R, an E or an SE[2]	*Curricular Area (Credit Hours)* Math & Basic Sciences	Discipline Specific Topics	General Education	Other	Last Two Terms the Course was Offered: Year and, Semester, or Quarter	Average Section Enrollment for the Last Two Terms the Course was Offered[1]
Year 1, Semester 1 (15 credits)							
MATH 191G, Calculus and Analytic Geometry I	R	4				F 2011 S 2012	40 40
PHYS 213 (or 215), Mechanics	R		3			F 2010 F 2011	28 28
PHYS 213L (or 215L), Experimental Mechanics	R		1			F 2010 F 2011	22 24
M E 102 (or AE102), Mechanical Engineering Orientation	R		1			F 2011 S 2012	53 32
M E 159, Graphical Communication and Design	R		2			F 2011 S 2012	41 41
ENGL 111G, Rhetoric and Composition	R			4		F 2011 S 2012	27 27
Year 1, Semester 2 (15 credits)							
MATH 192G, Calculus and Analytic Geometry II	R	4				F 2011 S 2012	40 40
PHYS 214 (or 216), Electricity and Magnetism	R		3			S 2011 S 2012	21 16
PHYS 214 (or 216L)L, Electricity and Magnetism Laboratory	R		1			S 2011 S 2012	21 12
CHEM 111G, General Chemistry	R	4				F 2011 S 2012	131 168
Written Communications Elective	SE			3		F 2011 S 2012	n/a n/a
Year 2, Semester 3 (16 credits)							

MATH 291G, Calculus and Analytic Geometry III	R	3				F 2011 S 2012	40 40
PHYS 217, Heat, Light, and Sound	R		3			F 2010 F 2011	29 30
PHYS 217L, Experimental Heat, Light, and Sound	R		1			F 2010 F 2011	17 15
M E 236, Engineering Mechanics I	R		3			F 2011 S 2012	45 38
M E 240, Thermodynamics	R		3			F 2011 S 2012	40 41
Oral Communication Elective	SE			3		F 2011 S 2012	n/a n/a
Year 2, Semester 4 (18 credits)							
MATH 392, Introduction to Ordinary Differential Equations	R	3				F 2011 S 2012	40 40
PHYS 315, Modern Physics	R		3			S 2011 S 2012	33 33
PHYS 315L, Experimental Modern Physics	R		3			S 2011 S 2012	20 23
M E 237, Engineering Mechanics II	R		3			F 2011 S 2012	38 27
C E 301, Mechanics of Materials	R		3			F 2011 S 2012	87 80
General Education Core Elective	SE			3		F 2011 S 2012	n/a n/a
Year 3, Semester 5 (18 credits)							
PHYS 395, Intermediate Math. Methods of Physics	R		3			-- F 2011	-- 21
PHYS 461, Intermediate Electricity and Magnetism I	R		3			F 2010 F 2011	14 17
A E 339, Aerodynamics I	R		3			F 2011 S 2012	59 39
A E 363, Aerospace Structures	R		3			F 2011 S 2012	47 38
A E 364, Flight Dynamics and Controls	R		3			F 2011 S 2012	50 26

General Education Core Elective	SE			3		F 2011 S 2012	n/a n/a
Year 3, Semester 6 (15 credits)							
PHYS 462, Intermediate Electricity and Magnetism II	R		3			S 2011 S 2012	11 16
M E 345, Experimental Methods I	R		3			F 2011 S 2012	39 44
A E 362, Orbital Mechanics	R		3			F 2011 S 2012	28 77
A E 439, Aerodynamics II	R		3			F 2011 S 2012	49 54
General Education Core Elective	SE			3		F 2011 S 2012	n/a n/a
Year 4, Semester 7 (18 credits)							
PHYS 454, Intermediate Modern Physics I	R		3			F 2010 F 2011	13 14
A E 419, Propulsion	R		3			F 2011 S 2012	35 29
A E 424, Aerospace Systems Engineering	R		3			F 2011 S 2012	43 40
A E 447, Aerofluidics Laboratory	R		3			F 2011 S 2012	37 32
PHYS / A E / M E, Technical Elective	E		3			F 2011 S 2012	n/a n/a
General Education Core Elective	SE			3		F 2011 S 2012	n/a n/a
Year 4, Semester 8 (15 credits)							
PHYS 455, Intermediate Modern Physics II	R		3			S 2011 S 2012	12 13
A E 428, Aerospace Capstone Design	R		3			F 2011 S 2012	28 41
Viewing a Wider World Elective (2 courses)	SE				3	F 2011 S 2012	n/a n/a
Viewing a Wider World Elective (2 courses)	SE				3	F 2011 S 2012	n/a n/a

General Education Core Elective	SE			3		F 2011 S 2012	n/a n/a
TOTAL CREDIT HOURS FOR THE DEGREE	**133**	**18**	**84**	**25**	**6**		
PERCENT OF TOTAL		**14%**	**63%**	**19%**	**4%**		

Table 5.1.b. Curriculum for Bachelor of Science in Engineering Physics – *Chemical Concentration*

Course (Department, Number, Title) List all courses in the program by term starting with first term of first year and ending with the last term of the final year.	Indicate Whether Course is Required, Elective, or a Selective Elective by an R, an E or an SE[2]	*Curricular Area (Credit Hours)*				Last Two Terms the Course was Offered: Year and, Semester, or Quarter	Average Section Enrollment for the Last Two Terms the Course was Offered[1]
		Math & Basic Sciences	Discipline Specific Topics	General Education	Other		
Year 1, Semester 1 (15 credits)							
MATH 191G, Calculus and Analytic Geometry I	R	4				F 2011 S 2012	40 40
PHYS 213 (or 215), Mechanics	R		3			F 2010 F 2011	28 28
PHYS 213L (or 215L), Experimental Mechanics	R		1			F 2010 F 2011	22 24
CH E 111, Introduction to Computer Calculations in CH E	R		3			F 2010 F 2011	25 31
CHEM 115, Principles of Chemistry I	R		4			F 2010 F 2011	58 51
Year 1, Semester 2 (16 credits)							
MATH 192G, Calculus and Analytic Geometry II	R	4				F 2011 S 2012	40 40
PHYS 214 (or 216), Electricity and Magnetism	R		3			S 2011 S 2012	21 16

PHYS 214L (or 216), Electricity and Magnetism Laboratory	R		1			S 2011 S 2012	21 12
CHEM 116, Principles of Chemistry II	R		4			S 2011 S 2012	41 33
ENGL 111G, Rhetoric and Composition	R			4		F 2011 S 2012	27 27
Year 2, Semester 3 (17 credits)							
MATH 291G, Calculus and Analytic Geometry III	R	3				F 2011 S 2012	40 40
PHYS 217, Heat, Light, and Sound	R		3			F 2010 F 2011	29 30
PHYS 217L, Experimental Heat, Light, and Sound	R		1			F 2010 F 2011	17 15
CH E 201, Material and Energy Balances	R		4			F 2010 S 2012	32 30
CHEM 313, Organic Chemistry I	R		3			F 2011 S 2012	149 143
Written Communication Elective	SE			3		F 2011 S 2012	n/a n/a
Year 2, Semester 4 (18 credits)							
MATH 392, Introduction to Ordinary Differential Equations	R	3				F 2011 S 2012	40 40
PHYS 315, Modern Physics	R		3			S 2011 S 2012	33 33
PHYS 315L, Experimental Modern Physics	R		3			S 2011 S 2012	20 23
CH E 301, Chemical Engineering Thermodynamics I	R		3			S 2011 S 2012	20 27
CH E 305, Transport Operations I	R		3			S 2011 S 2012	20 28
Oral Communication Elective	SE			3		F 2011 S 2012	n/a n/a
Year 3, Semester 5 (18 credits)							
PHYS 395, Intermediate Math. Methods of Physics	R		3			-- F 2011	-- 21

PHYS 461, Intermediate Electricity and Magnetism I	R		3			F 2010 F 2011	14 17
CH E 302, Chemical Engineering Thermodynamics II	R		3			F 2010 F 2011	21 17
CH E 302L, Thermodynamic Models of Phys. Properties	R		1			-- F 2011	-- 17
CH E 306, Transport Operations II	R		3			F 2010 F 2011	18 17
CHEM 314, Organic Chemistry II	R		3			F 2011 S 2012	46 65
CHEM 315, Organic Chemistry Laboratory	R		2			F 2011 S 2012	21 20
Year 3, Semester 6 (16 credits)							
PHYS 462, Intermediate Electricity and Magnetism II	R		3			S 2011 S 2012	11 16
CH E 307, Transport Operations III	R		3			S 2011 S 2012	22 14
CH E 352L, Simulation of Unit Operations	R		1			-- S 2012	-- 15
CH E 361, Engineering Materials	R		3			F 2011 S 2012	73 81
CH E 441, Chemical Kinetics and Reactor Engineering	R		3			S 2011 S 2012	20 17
General Education Core Elective	SE			3		F 2011 S 2012	n/a n/a
Year 4, Semester 7 (15 credits)							
PHYS 454, Intermediate Modern Physics I	R		3			F 2010 F 2011	13 14
PHYS 451, Intermediate Mechanics	R		3			F 2010 F 2011	5 12
Viewing a Wider World Elective	SE				3	F 2011 S 2012	n/a n/a
General Education Core Elective	SE			3		F 2011 S 2012	n/a n/a
General Education Core Elective	SE			3		F 2011 S 2012	n/a n/a

Year 4, Semester 8 (15 credits)							
PHYS 455, Intermediate Modern Physics II	R		3			S 2011 S 2012	12 13
PHYS 475, Advanced Physics Laboratory	R		3			S 2011 S 2012	8 11
Viewing a Wider World Elective	SE				3	F 2011 S 2012	n/a n/a
General Education Core Elective	SE			3		F 2011 S 2012	n/a n/a
General Education Core Elective	SE			3		F 2011 S 2012	n/a n/a
TOTAL CREDIT HOURS FOR THE DEGREE	**134**	**14**	**89**	**25**	**6**		
PERCENT OF TOTAL		**10%**	**68%**	**18%**	**4%**		

Table 5.1.c. Curriculum Bachelor of Science in Engineering Physics – *Electrical Concentration*

Course (Department, Number, Title) List all courses in the program by term starting with first term of first year and ending with the last term of the final year.	Indicate Whether Course is Required, Elective, or a Selective Elective by an R, an E or an SE[2]	*Curricular Area (Credit Hours)*				Last Two Terms the Course was Offered: Year and, Semester, or Quarter	Average Section Enrollment for the Last Two Terms the Course was Offered[1]
		Math & Basic Sciences	Discipline Specific Topics	General Education	Other		
Year 1, Semester 1 (16 credits)							
MATH 191G, Calculus and Analytic Geometry I	R	4				F 2011 S 2012	40 40
PHYS 213 (or 215), Mechanics	R		3			F 2010 F 2011	28 28
PHYS 213L (or 215L), Experimental Mechanics	R		1			F 2010 F 2011	22 24

E E 161, Computer Aided Problem Solving	R		4			F 2011 S 2012	66 50
ENGL 111G, Rhetoric and Composition	R			4		F 2011 S 2012	27 27
Year 1, Semester 2 (16 credits)							
MATH 192G, Calculus and Analytic Geometry II	R	4				F 2011 S 2012	40 40
PHYS 214 (or 216), Electricity and Magnetism	R		3			S 2011 S 2012	21 16
PHYS 214L (or 216L), Electricity and Magnetism Laboratory	R		1			S 2011 S 2012	21 12
E E 162, Digital Circuits Design	R		4			F 2011 S 2012	34 26
CHEM 111G, General Chemistry	R	4				F 2011 S 2012	131 168
Year 2, Semester 3 (18 credits)							
MATH 291G, Calculus and Analytic Geometry III	R	3				F 2011 S 2012	40 40
PHYS 217, Heat, Light, and Sound	R		3			F 2010 F 2011	29 30
PHYS 217L, Experimental Heat, Light, and Sound	R		1			F 2010 F 2011	17 15
E E 210, Engineering Analysis I	R		4			F 2011 S 2012	43 43
E E 260, Embedded Systems	R		4			F 2011 S 2012	46 29
Written Communication Elective	SE			3		F 2011 S 2012	n/a n/a
Year 2, Semester 4 (16 credits)							
MATH 392, Introduction to Ordinary Diff. Equations	R	3				F 2011 S 2012	40 40
PHYS 315, Modern Physics	R		3			S 2011 S 2012	33 33
PHYS 315L, Experimental Modern Physics	R		3			S 2011 S 2012	20 23

E E 280, DC and AC Circuits	R		4			F 2011 S 2012	25 23
Oral Communication Elective	SE			3		F 2011 S 2012	n/a n/a
Year 3, Semester 5 (16 credits)							
PHYS 395, Intermediate Math. Methods of Physics	R		3			-- F 2011	-- 21
PHYS 451, Intermediate Mechanics	R		3			F 2010 F 2011	5 12
PHYS 461, Intermediate Electricity and Magnetism I	R		3			F 2010 F 2011	14 17
E E 312, Signals and Systems I	R		3			F 2011 S 2012	41 40
E E 380, Electronics I	R		4			F 2011 S 2012	26 30
Year 3, Semester 6 (18 credits)							
PHYS 480, Thermodynamics	R		3			S 2010 S 2012	13 18
PHYS 475, Advanced Physics Laboratory	R		3			S 2011 S 2012	8 11
PHYS 462, Intermediate Electricity and Magnetism II	R		3			S 2011 S 2012	11 16
PHYS / E E, Technical Elective	E		3			F 2011 S 2012	n/a n/a
General Education Core Elective	SE			3		F 2011 S 2012	n/a n/a
General Education Core Elective	SE			3		F 2011 S 2012	n/a n/a
Year 4, Semester 7 (15 credits)							
PHYS 454, Intermediate Modern Physics I	R		3			F 2010 F 2011	13 14
E E 418, Capstone Design I	R		3			F 2011 S 2012	4 4
Viewing a Wider World Elective	SE				3	F 2011 S 2012	n/a n/a

General Education Core Elective	SE			3		F 2011 S 2012	n/a n/a
General Education Core Elective	SE			3		F 2011 S 2012	n/a n/a
Year 4, Semester 8 (15 credits)							
PHYS 455, Intermediate Modern Physics II	R		3			S 2011 S 2012	12 13
E E 419, Capstone Design II	R		3			F 2011 S 2012	4 4
PHYS / E E, Technical Elective	E		3			F 2011 S 2012	n/a n/a
Viewing a Wider World Elective	SE				3	F 2011 S 2012	n/a n/a
General Education Core Elective	SE			3		F 2011 S 2012	n/a n/a
TOTAL CREDIT HOURS FOR THE DEGREE	**133**	**18**	**84**	**25**	**6**		
PERCENT OF TOTAL		**14%**	**63%**	**19%**	**4%**		

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

Course (Department, Number, Title) **List all courses in the program by term starting with first term of first year and ending with the last term of the final year.**	**Indicate Whether Course is Required, Elective, or a Selective Elective by an R, an E or an SE[2]**	***Curricular Area (Credit Hours)*** **Math & Basic Sciences**	**Discipline Specific Topics**	**General Education**	**Other**	**Last Two Terms the Course was Offered: Year and, Semester, or Quarter**	**Average Section Enrollment for the Last Two Terms the Course was Offered[1]**
Year 1, Semester 1 (15 credits)							
MATH 191G, Calculus and Analytic Geometry I	R	4				F 2011	40

						S 2012	40
PHYS 213 (or 215), Mechanics	R		3			F 2010 F 2011	28 28
PHYS 213L (or 215L), Experimental Mechanics	R		1			F 2010 F 2011	22 24
M E 102, Mechanical Engineering Orientation	R		1			F 2011 S 2012	53 32
M E 159, Graphical Communication and Design	R		2			F 2011 S 2012	41 41
CHEM 111G, General Chemistry	R	4				F 2011 S 2012	131 168
Year 1, Semester 2 (15 credits)							
MATH 192G, Calculus and Analytic Geometry II	R	4				F 2011 S 2012	40 40
PHYS 214 (or 216), Electricity and Magnetism	R		3			S 2011 S 2012	21 16
PHYS 214L (or 216L), Electricity and Magnetism Laboratory	R		1			S 2011 S 2012	21 12
M E 240, Thermodynamics	R		3			F 2011 S 2012	40 41
ENGL 111G, Rhetoric and Composition	R			4		F 2011 S 2012	27 27
Year 2, Semester 3 (17 credits)							
MATH 291G, Calculus and Analytic Geometry III	R	3				F 2011 S 2012	40 40
PHYS 217, Heat, Light, and Sound	R		3			F 2010 F 2011	29 30
PHYS 217L, Experimental Heat, Light, and Sound	R		1			F 2010 F 2011	17 15
M E 236, Engineering Mechanics I	R		3			F 2011 S 2012	45 38
M E 261, Mechanical Engineering Problem Solving	R		4			F 2011 S 2012	33 40
Written Communication Elective	SE			3		F 2011 S 2012	n/a n/a

Year 2, Semester 4 (18 credits)							
MATH 392, Introduction to Ordinary Diff. Equations	R	3				F 2011 S 2012	40 40
PHYS 315, Modern Physics	R		3			S 2011 S 2012	33 33
PHYS 315L, Experimental Modern Physics	R		3			S 2011 S 2012	20 23
M E 237, Engineering Mechanics II	R		3			F 2011 S 2012	38 27
C E 301, Mechanics of Materials	R		3			F 2011 S 2012	87 80
Oral Communication Elective	SE			3		F 2011 S 2012	n/a n/a
Year 3, Semester 5 (18 credits)							
PHYS 395, Intermediate Math. Methods of Physics	R		3			-- F 2011	-- 21
PHYS 461, Intermediate Electricity and Magnetism I	R		3			F 2010 F 2011	14 17
M E 326, Mechanical Design	R		3			F 2011 S 2012	25 27
M E 328, Engineering Analysis I	R		3			F 2011 S 2012	49 42
M E 338, Fluid Mechanics	R		3			F 2011 S 2012	34 25
General Education Core Elective	SE			3		F 2011 S 2012	n/a n/a
Year 3, Semester 6 (15 credits)							
PHYS 462, Intermediate Electricity and Magnetism II	R		3			S 2011 S 2012	11 16
M E 341, Heat Transfer	R		3			F 2011 S 2012	31 37
PHYS / M E, Technical Elective	E		3			F 2011 S 2012	n/a n/a
General Education Core Elective	SE			3		F 2011 S 2012	n/a n/a

General Education Core Elective	SE			3		F 2011 S 2012	n/a n/a
Year 4, Semester 7 (18 credits)							
PHYS 454, Intermediate Modern Physics I	R		3			F 2010 F 2011	13 14
PHYS 451, Intermediate Mechanics	R		3			F 2010 F 2011	5 12
M E 426, Design Project Laboratory I	R		3			F 2011 S 2012	40 24
Viewing a Wider World Elective	SE				3	F 2011 S 2012	n/a n/a
General Education Core Elective	SE			3		F 2011 S 2012	n/a n/a
General Education Core Elective	SE			3		F 2011 S 2012	n/a n/a
Year 4, Semester 8 (16 credits)							
PHYS 455, Intermediate Modern Physics II	R		3			S 2011 S 2012	12 13
PHYS 475, Advanced Physics Laboratory	R		3			S 2011 S 2012	8 11
M E 427, Design Project Laboratory II	R		3			F 2011 S 2012	18 38
M E 449, Mechanical Engineering Senior Seminar	R		1			F 2011 S 2012	38 41
Viewing a Wider World Elective	SE				3	F 2011 S 2012	n/a n/a
TOTAL CREDIT HOURS FOR THE DEGREE	**132**	**18**	**83**	**25**	**6**		
PERCENT OF TOTAL		**14%**	**63%**	**19%**	**4%**		

- *For courses that include multiple elements (lecture, laboratory, recitation, etc.), indicate the average enrollment in each element.*
- *Required courses are required of all students in the program, elective courses are optional for students, and selected electives are courses where students must take one or more courses from a specified group.*

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

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

Objective 1: Competitiveness. The curriculum of the Engineering Physics program has been specifically designed to enable students acquire strong fundamental knowledge in physics and the chosen engineering field, adopt effective communication and problem-solving skills, develop the ability to tackle new problems, and achieve a level of preparation that allows continuation to advanced studies after graduation. Each of the four program concentrations requires students to complete at least 14-18 credits of mathematics and basic sciences, 36 credit hours of physics, and 33-45 credit hours of specialized engineering courses. The strong foundation of fundamental science courses and a broad range of specialized engineering courses help ensure that the Engineering Physics graduates are competitive in internationally-recognized academic, government and industrial environments.

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

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

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

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

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

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

Physics Course	**Program Outcomes**										
	(a)	***(b)***	***(c)***	***(d)***	***(e)***	***(f)***	***(g)***	***(h)***	***(i)***	***(j)***	***(k)***
PHYS 213 or 215,	**X**										
PHYS 213L or 215L		**X**									
PHYS 214 or 216	**X**										
PHYS 214L or 216L		**X**									
PHYS 217	**X**										
PHYS 217L		**X**	**N**	**N**							
PHYS 315	**X**					**X**		**X**	**X**	**X**	
PHYS 315L		**X**	**a**	**X**			**X**				**X**
PhHYS 395 (new)						**N**					
PHYS 451					**X**						
PHYS 454 & 455,					**X**						
PHYS 450 - Capstone			**X**	**X**			**X**				**X**
PHYS 461 a & 462					**X**						
PHYS 475		**X**	**a**	**X**			**X**				**X**
PHYS 480					**X**						
Physics Electives			**a**	**a**		**a**		**a**	**a**	**a**	**a**

a: whether this Program Outcome is measured depends on the individual instructor and/or the course
N: indicates new assessment

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

Suggested flowcharts for each of the four concentrations (*Aerospace*, *Chemical*, *Electrical* and *Mechanical*) of the Engineering Physics program are given in Diagram 5.1.a-d.

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

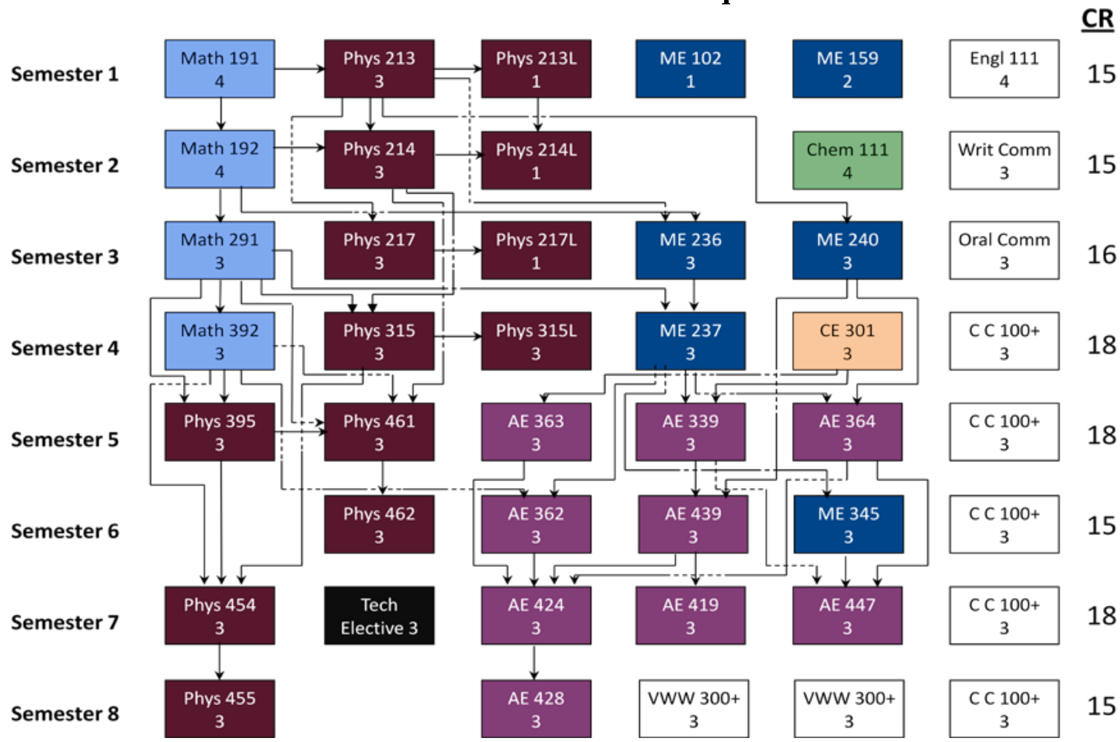


Diagram 5.1.b. Proposed Schedule for *Engineering Physics with the Chemical Concentration*. Arrows coming in from the top indicate pre-requisite requirements. Arrows from the site indicate co-requisites.

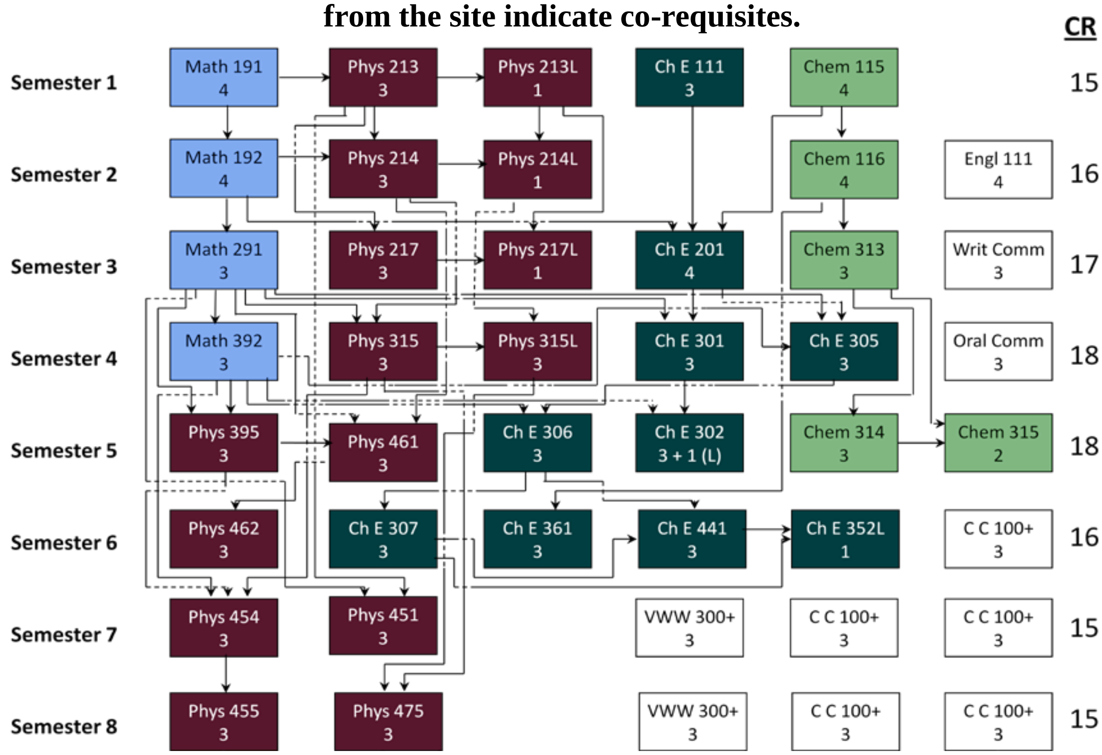


Diagram 5.1.c. Proposed Schedule for *Engineering Physics with the Electrical Concentration*. Arrows coming in from the top indicate pre-requisite requirements. Arrows from the site indicate co-requisites.

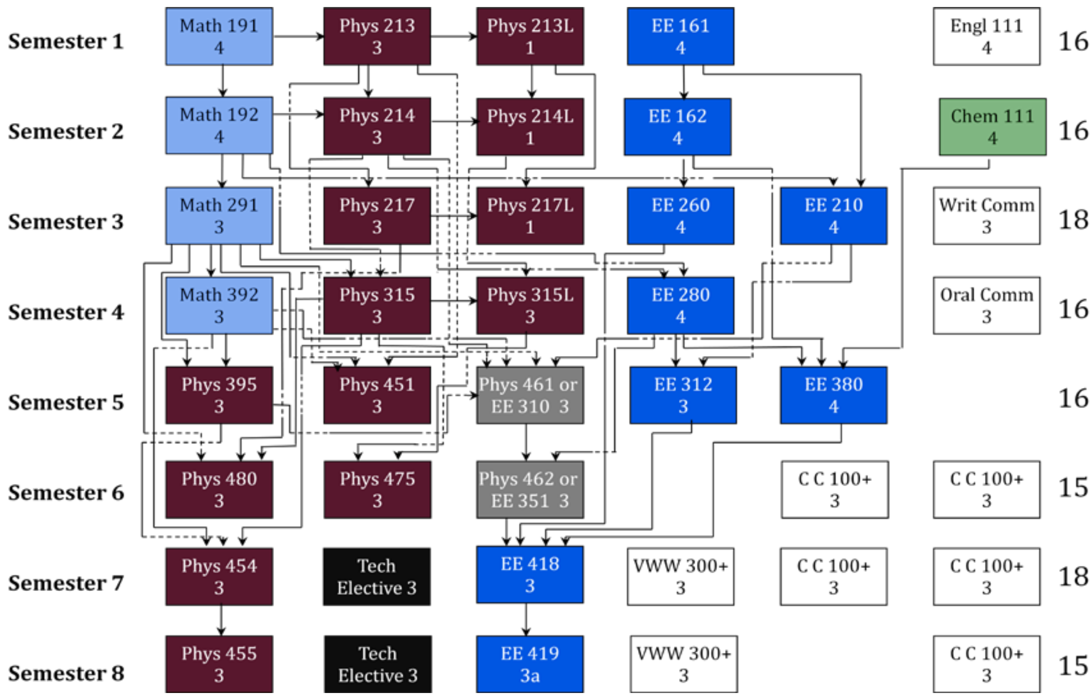
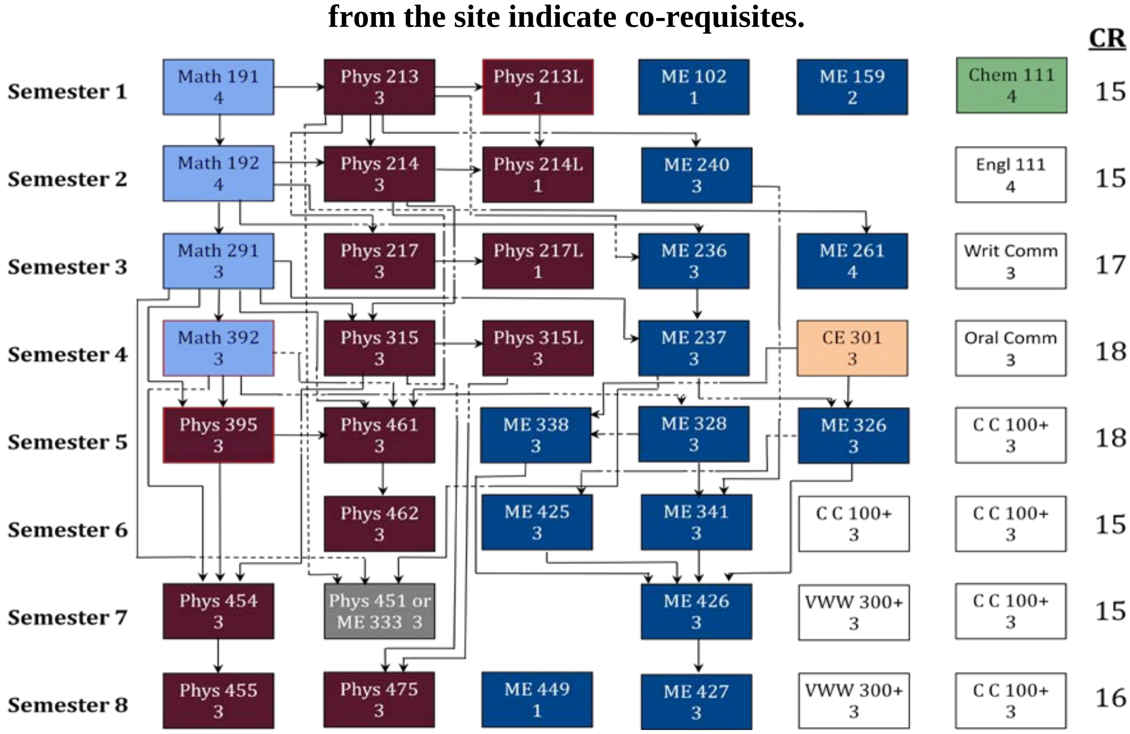


Diagram 5.1.d. Proposed Schedule for *Engineering Physics with the Mechanical Concentration*. Arrows coming in from the top indicate pre-requisite requirements. Arrows from the site indicate co-requisites.



4. For each curricular area specifically addressed by either the general criteria or the program criteria as shown in Table 5-1, describe how your program meets the specific requirements for this program area in terms of hours and depth of study.

Physics Courses (33-42 credits)

Students enrolled in each of the four Engineering Physics concentrations are required to complete 36 credits of physics courses. The central part of this requirement is represented by the core sequence of physics courses offered to the physics majors. The sequence includes 3 introductory level physics courses combined with physics laboratories, 2 intermediate level courses designed to prepare students for the upper division physics classes, and 5-7 advanced physics courses that cover a variety of subjects, including classical mechanics, quantum mechanics, electromagnetic theory, thermodynamics, and advanced physics laboratory. For the individual Engineering Physics concentrations, the physics sequence is designed to complement, rather than duplicate, the engineering sequence so that students gain a broad physics background.

Specialized Engineering Courses (33-44 credits)

A broad-based foundation in technical and engineering courses prepares Engineering Physics graduates for a variety of employment opportunities. The Engineering Physics program at New Mexico State University offers students a selection of four different concentrations: *Aerospace, Chemical*, *Electrical*, and *Mechanical*. Students electing the *Mechanical concentration* are required to complete 38 credits of mechanical and civil engineering courses. The *Electrical concentration* requires students to complete 33 credits of electrical engineering courses. Students enrolled in the *Aerospace concentration* have to complete 18 credits of mechanical and 27 credits of aerospace engineering courses. The *Chemical concentration* requires students to complete 16 credits of chemistry and 30 credits of chemical engineering courses. The selection of specialized courses is aligned with the *Educational Objectives* of the Engineering Physics program at New Mexico State University.

Mathematics (14 credits)

All students enrolled in the Engineering Physics program at New Mexico State University 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.

Chemistry (4-16 credits)

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

English and Communications (10 credits)

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

General Education Courses in Common Core Areas IV and V (15 credits)

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

Viewing a Wider World Courses (6 credits)

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

5. If your program has a capstone or other culminating experience for students specifically addressed by either the general or program criteria, describe how this experience helps students attain the student outcomes.

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 back on prerequisite topics and apply cumulative knowledge that have previously been developed as part of *Program Outcome (a) - Scientific Expertise*, *Program Outcome (e) - Problem Solving*, and *Program Outcome (k) - Technical Know-how*. However, such background itself is not enough, as capstone projects require students to build on their backgrounds through research and development therefore *Program Outcomes (i) - Lifelong learning*, Progr*am Outcome (b) - Experimental Training* and most importantly *Program Outcome (c) - Design Abilities.* Moreover, capstone courses require that students work in teams, often with students who have different backgrounds, thus addressing *Program Outcome (d) – Teamwork* and Program Outcome (g) – Communication Skills. The need to work in teams also develops the students' sense of *Program Outcome (f) - Professional Responsibility*. In other words, capstone design courses expose students (often for the first time) to demands and expectations that they would likely encounter in their future profession.

The College of Arts & Sciences still enforces a 10-student minimum for undergraduate courses, and this poses a problem for a still relatively small program, such as Engineering Physics where we currently have just ~4-5 seniors, who take the capstones in the same semester. Moreover, this number is further diluted by the fact that our Engineering Physics students are distributed over the four different concentrations. It should be pointed out that the low number of Engineering Physics 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 had been the main reason that we had originally envisioned capstones to be run fully in the participating engineering departments, where sufficient enrollment is ensured due to the much larger numbers of their majors. While each engineering capstone consists of 3-5 students, the engineering departments offer all of their capstones under one course number, thus easily escaping the 20-student minimum requirement.

On the other hand, not having a dedicated capstone in the Engineering Physics program itself was considered an *area of concern* in the 2006 ABET review, a viewpoint that was also shared with our External Advisory Board in 2010. Recognizing its importance, the Engineering Physics Program Committee came up with the following approaches:

1) Try to offer a capstone design course (*PHYS 450 – Capstone*) that attract large numbers of other engineering students as well;
2) Offer capstone design projects (also under *PHYS 450*) as part of (independently funded) research or demonstration -equipment development activities (which don't provide course credit for the instructor anyway);
3) Suggest capstone design projects through any of the participating engineering departments;
4) Participate in the evaluation of engineering capstone projects taken by one or more Engineering Physics students.

The course number *PHYS 450* is listed in the Undergraduate Catalog as a general *Selected Topics* course, and it is used for a variety of specialized courses. Subtitles, such as *Capstone I* or *Capstone II* are to be provided by the instructor and they will be listed on the student's transcript.

Although we were able to attract some engineering students into *PHYS 450*, the first approach proved to be too optimistic with current enrollments. However, we did have some success with each of the other approaches. Table 5.3 provides a list of capstone design courses, where physics faculty members were involved in recent years,

Table 5.3 indicates that physics faculty members have participated and will continue to participate (in one way or another) in the capstone design projects of our Engineering Physics students. In recent years, physics faculty members were involved in capstone projects for more than half our Engineering Physics students. The percentage would have been even higher if it wasn't for the period between Fall of 2009 and Spring of 2011, where the Department of Physics had limited space and resources because of the renovation of Gardiner Hall. Moreover, we expect the Engineering Physics enrollment to further increase, which in turn will allow holding more own capstone projects in future. Several of the members of the 2012/2012 External Advisory Board have shown great interest in proposing capstones with NMSU's Engineering Physics program in future (for example, Ron Tafoya from Intel, Steve Castillo from Sandia National Laboratories and

Table 5.3. Capstone Design Courses with involvement of physics faculty. Names of physics faculty members involved in project evaluation are indicated in brackets.

Project Title	Semesters offered	Course	Faculty Advisor	Total number of Students	Number of EP students	Physics Faculty Involvement
Software Suite for scattering data from liquids and amorphous materials	Fall 07	PHYS 450	Jacob Urquidi (Physics)	3	1[a)]	Fully run by Physics
HIVE: Hub Integrated Visual Extension	Spring 08	EE 418/419	Mike DeAntonio (Physics)	6	0[b)]	Fully run by Physics
GM Engine Development – Improve Fuel Efficiency	Fall 07 and Spring 08	ME 426/427	Young-Ho Park (ME)	4	2	Participated in Evaluation (Nakotte)
Biomass: Generator fueled with cow manure	Fall 07 and Spring 08	ME 426/427	Young-Ho Park (ME)	4	2	Participated in Evaluation (Pate)
Network Camera – Sky Imaging	Fall 09 and Spring 10	EE 418/419	Steve Stochaj (EE)	5	1	Participated in Evaluation (Nakotte)
Physics Demo: Crashing Al cans with Electromagnetic Induction	Spring 10 and Fall 12[c)]	PHYS 450	Steve Kanim (Physics)	3	2	Fully run in Physics
Physics Demo: Circular 24-pendulum assembly	Spring 12 and Fall 12	PHYS 450	Steve Kanim (Physics)	4	3	Fully run in Physics
Landmine seeker – Ordnance Bot	Fall 11 and Spring 12[c)]	EE 418/419	Steve Stochaj (EE)	4	2	Participated in Evaluation (Nakotte)

[a)]EP student did not finish the capstone project, [b)]no EP student enrolled, but offered by physics faculty member, [c)]2nd part of capstone is scheduled in Fall 2012

6. If your 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 Engineering Physics curriculum requirements. However, individual faculty members work with both students and employers to help facilitate appropriate opportunities.

7. Describe by example how the evaluation team will be able to relate the display materials, i.e. course syllabi, textbooks, sample student work, etc., to each student outcome. (See the 2011-2012 APPM section II.G.6.b.(2) regarding display materials.)

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

B. Course Syllabi

In Appendix A, include a syllabus for each course used to satisfy the mathematics, science, and discipline-specific requirements required by Criterion 5 or any applicable program criteria. For required courses with multiple sections that do not use a common syllabus, please include a syllabus for each of the different sections.

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

Criterion 6: Faculty

Engineering Physics

Bachelor of Science in Engineering Physics

Self-Study Report

New Mexico State University

June 2012

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. 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 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 Mechanical & Aerospace Engineering (ME/AE), Electrical Engineering (EE) and Chemical Engineering (Ch E) in the College of Engineering. Specialty courses in, Aerospace Engineering, Chemical Engineering, Electrical Engineering and Mechanical 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, in particular between Electrical Engineering 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, Aerospace & Mechanical Engineering, Electrical Engineering and Chemical Engineering are summarized in Table 6-1.a-d. The combination of Physics and Engineering faculty is well qualified to cover all the curricular areas of the Engineering Physics (EP) program.

As of May 2012, the Physics faculty consists of the following:

- thirteen tenured faculty members (12.5 full time equivalent lines),
- two college faculty members with teaching responsibilities (1.0 full-time equivalent).
- two emeritus professors with teaching responsibilities,
- one part-time community college professor with teaching responsibilities,
- one professional staff member with responsibility for instructional support and involvement in instructional laboratory development,
- three graduate teaching assistants with outstanding teaching skills, who are assigned as instructors of record for introductory physics courses,
- one staff member in charge to help with outreach, websites, retention and recruitment.

All faculty members, who teach courses needed for the Engineering Physics program, have Doctorate degrees in Physics, other Sciences or Engineering. The professional support staff member has an M.S. degree in Electrical Engineering. Only truly outstanding graduate assistants (top 5%) are assigned as lecturers for introductory physics courses. Resumes of all faculty members, staff and graduate students who have been involved in teaching duties are provided in Appendix B. The faculty, teaching assistants, and staff are well qualified to teach the required curriculum.

Three of the physics faculty members (Drs William Gibbs, Matthias Burkardt, Stefan Zollner) are Fellows of the American Physical Society (APS). Dr. Zollner has served a four-year term in the FIAP (Forum of Industrial and Applied Physics of the APS) Chair-line, a four-year term as FIAP Councilor, a four-year term on the APS Council, a two-year term on the APS Executive Board, and on many APS committees. Dr. De Antonio has served in the Chair line of the Physics

Committee of the American Society for Engineering Education (ASEE). Dr. Nakotte has served a four-year term as a member of the Executive Committee of the Four Corners Section of the APS. Lina Abdallah currently serves as the student member of the Executive Committee of the Four Corners Section of the APS. Dr. Zollner also serves two-year terms on the executive committees of the New Mexico Chapter and the Electronic Materials and Processing Division of the American Vacuum Society (AVS). Dr. Matthias Burkardt currently serves a four-year term in the Chair-line of the Topical Group on Hadronic Physics in the APS. Dr. Gibbs serves as an Associate Editor for the journal The Physical Review C published by the APS. Other accomplishments of faculty are listed in the Appendix B.

B. Faculty Workload

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

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

As can be seen in Table 6.2.a, the teaching loads in the Department of Physics are relatively low. In the College of Arts & Sciences, the nominal teaching load for tenured and tenure-track faculty of a PhD-granting department (such as Physics) is three formal courses (9 credit hours) per year, which is considered to be a 37.5% teaching load. In addition, regular faculty members are expected to carry out active externally funded research programs, support and supervise undergraduate and graduate student research, and perform service. The entire regular (tenured) faculty and both emeritus faculty members have active research programs, most of them externally supported by government or industrial agencies. Many faculty further reduce their teaching load by using grant funds to “buy out” academic year teaching and spend more time on research. One tenured faculty member (William Gibbs) has a 50% position and also works as an Associate Editor for the high-impact *Physical Review* journal. The strong funded research component allows the department to offer well supported undergraduate and graduate research opportunities. Unlike Physics, there is no similar (fairly) uniform percent allocation in the engineering departments (College of Engineering), and the distribution of effort is typically left to the individual departments and their heads.

Faculty members are evaluated annually for their performance in the areas of teaching, research, outreach, and service as specified by the College of Arts & Sciences and NMSU policy and procedures. The evaluation is performed by a committee consisting of two tenured faculty members elected by the faculty and the Department Head. This evaluation is used as the primary basis for awarding merit-based salary increases, and 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 is evaluated on the basis of number and quality of publications, conference presentations, proposals submitted and funded, and support of students. Service can include professional service, such as refereeing publications or proposals, organization of conferences, service on university committees, and community service. Major prizes won in any of these areas also influence the rating. In addition to the annual evaluations faculty are also evaluated every 3 to 5 years by the Graduate School for membership on the graduate faculty. The primary criteria are a) creative activity; b) continual study in their field; and c) successful teaching.

C. Faculty Size

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

The size of the physics faculty is adequate to teach all courses required for the engineering physics curriculum at least once per year. First-year introductory physics courses are taught in both fall and spring semesters and usually also during the summer. Like many science departments, the Department of Physics has lost many faculty members over the last 20 years. We have responded to this loss of faculty lines by reducing the frequency of physics electives or by eliminating them entirely. For example, *Introduction to Optics* has only been taught once in two years. *Experimental Nuclear Physics* will be taught in the fall of 2012 for the first time in many years. To increase elective opportunities for students, some courses are taught jointly between physics and engineering, for example *Introduction to Nanotechnology* (with Chemical Engineering), *Optics* (with Electrical Engineering), and *Modern Materials* (taught by Physics).

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

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

The most significant challenge related to faculty is the following: Due to space limitations in **Gardiner Hall**, very limited start-up funds for new faculty, and limited cash cost-share contributions for equipment proposals, only two tenured faculty members (Drs Stefan Zollner, Jacob Urquidi) have on-campus physics research laboratories suitable for capstone projects related to undergraduate research. Therefore, most Engineering Physics students typically fulfill their capstone requirement either utilizing research facilities that are available in the engineering departments or by the design of physics demonstrations. Moreover, a substantial fraction of physics faculty members perform theoretical research or experimental off-campus research (especially at National Laboratories, such as Los Alamos, Brookhaven, or Fermi Lab).

Nevertheless, the shortage of experimental facilities in the Department of Physics limits employment opportunities for students as undergraduate research aides or for undergraduate research and capstone projects.

D. Professional Development

Describe the professional development activities that are available to faculty members.

All tenured faculty members are eligible for sabbaticals as described in NMSU Policy Manual Section 7.20.70. "*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, or Jefferson Laboratory 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. Many of the colloquium series are done jointly with other departments.

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

The Department of Physics (from its operational I&G funds) and the College of Arts & Sciences provide travel support for College Faculty to attend a regional or national meeting on Physics Education (such as the annual meeting of the American Society of Engineering Education or the American Association of Physics Teachers). Sometimes, such attendance is also supported by the conference organizers. 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.

To facilitate informal sharing of information between faculty members, the physics faculty members meet once a week for a brown-bag lunch in the physics conference room. 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 and the Physics External Advisory Board (two separate entities) also provide valuable information, advice, and recommendations to the physics faculty, both in their reports and also in meetings with individual faculty or with groups of faculty.

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

E. Authority and Responsibility of Faculty

Describe the role played by the faculty with respect to their guidance of the program, and in the development and implementation of the processes for the evaluation, assessment, and continuing improvement of the program, including its program educational objectives and 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 engineering physics 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 Engineering Physics students only. There are two reasons for that: a) the number of EP students is still too low (35 students in Spring 2012) in order to ensure the minimum enrollment of 10 students required for any undergraduate course, and b) none of the departments has the personnel strength to teach additional courses. In Table 6.2, we list only the physics and engineering courses, which have been (or could have been) taken by Engineering Physics students in order to fulfill courses requirements or electives. Generally, the majority of students enrolled in those courses were other engineering or science (including physics) majors.

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

1. NMSU considers eight 3-credit courses per semester as a full load. i.e. each course counts for 12.5% of time commitment. Given that undergraduate enrollments of physics and Engineering Physics majors are fairly similar, we can estimate that teaching three relevant undergraduate courses per year (1.5 per semester) therefore translate to 18.75% of time commitment due to *actual teaching in the EP program*. For any of the physics courses, the faculty member was given full credit as he/she is expected to fully comply with all Engineering Physics assessment requirements, regardless whether there several or no Engineering Physics students enrolled in the course. For any engineering course, the faculty member received only half of the credit since none of those courses has any EP-specific assessment requirements.
2. Some of differences between *actual teaching in the EP program* and *percentage teaching assignment* (column 4 in Table 6.2) is due to teaching of non-relevant (e.g. physics for non-science majors, graduate courses); however some of it can be attributed to course

curriculum development and/or advising. Curriculum changes are proposed by the Engineering Physics Program Committee, reviewed by the Physics Department Curriculum Committee, and then approved by the entire physics faculty in a faculty meeting. Therefore, all physics faculty members are involved in course/curriculum development for the Engineering Physics program, and we estimated the commitment as 2.5% (for non-members of the Curriculum Committee), 5% (for members) and 7.5% (for the Curriculum Committee Chair, Dr. Igor Vasiliev)..

3. The time commitment of faculty members involved in advising of Engineering Physics students was estimated at 5%.
4. Time commitments for serving on the Engineering Physics Program Committee were estimated at 5% for committee members (including *ex officio*) and 10% for the Chair of the Committee Dr. (Heinz Nakotte).
5. Faculty members who worked with Engineering Physics students on research or educational projects in the past year received another 5%.
6. The resulting percentages of time devoted were then rounded to next integer. It has to be pointed out that some of the contributions are not solely dedicated to Engineering Physics alone (i.e. the contributions computed from teaching).

The percentage of time devoted to the engineering physics program is listed in the last column in Table 6.2. It does not include advising of graduate student research, teaching of graduate courses, and teaching of algebra-based or conceptual physics courses (including Viewing-the-Wider-World courses). A faculty member on sabbatical will also, by definition, contribute very little to the engineering physics 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 one outcome and he or she reviews all relevant post-instruction forms for this outcome. There is an annual assessment faculty meeting, where the faculty report on their outcomes and discuss solutions to address findings and improve the program. This ensures that all faculty members have a stake in the engineering physics program and contribute to continuous improvement. All faculty members meet with the engineering physics advisory board members during a pizza lunch at the annual board meeting. Many faculty members contributed to the writing of the ABET self-study. In particular, assessment of individual program outcomes and compilation of different criteria for this Self-Study Report were assigned to different faculty members.

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

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

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

Faculty Name	Highest Degree Earned- Field and Year	Rank [1]	Type of Academic 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
Matthias Burkardt	Ph.D. Physics 1989	P	T	FT	2	15	17	NA	M	H	L
Michaela Burkardt	Ph.D. Physics 1992	ASC	NTT	PT	2	10	10	NA	L	M	L
Michael DeAntonio	Ph.D. Physics 1993	ASC	NTT	PT	12	11	10	NA	H	H	H
Michael Engelhardt	Ph.D. Physics 1994	ASC	T	FT	11	7	8	NA	L	H	L
William Gibbs	Ph.D. Physics 1961	P	T	PT	30	11	11	NA	H	M	L
Thomas Hearn	Ph.D. Geophysics 1985	ASC	T	FT	1	11	12	NA	L	H	L
Stephen Kanim	Ph.D. Physics 1999	ASC	T	FT	8	19	14	NA	L	H	L
Boris Kiefer	Ph.D. Mineral Physics 2002	ASC	T	FT	0	9	9	NA	L	H	M
Heinz Nakotte	Ph.D. Physics 1994	P	T	FT	18	13	15	NA	M	H	L
James Ni	Ph.D. Geophysics 1984	P	T	FT	3	26	28	NA	L	H	L
Vassilios Papavassiliou	Ph.D. 1988	ASC	T	FT	4	16	17	NA	L	H	L
Stephen Pate	Ph.D. Physics 1987	P	T	FT	0	17	17	NA	L	H	L

Jacob Urquidi	Ph.D. Physical Chemistry 2001	ASC	T	FT				NA	L	M	L
Igor Vasiliev	Ph.D. Materials Science 2000	ASC	T	FT	1	9	10	NA	L	H	L
Stefan Zollner	Ph.D. Physics 1991	P	T	FT	14	7	2	NA	H	H	H
Peter de Châtel	Ph.D. Physics 1988	A	NTT	PT	7	37	11	NA	L	M	L
Tarlochan Dhillon	Ph.D. Materials Science and Engineering 1999	A	NTT	PT	0	40	6	NA	L	H	L
George Goedecke	Ph.D. Physics 1961	A	NTT	PT	3	51	51	NA	L	M	L
Lina Abdallah	M.S. Physics 2009	O	NTT	PT	0	2	2	NA	M	H	L
Manal Abdallah	M.S. Physics 2009	O	NTT	PT	0	13	1	NA	L	H	L
Sophia Cisneros	Ph.D. Physics 2011	O	NTT	PT				NA	L	H	L
Chris Pennise	M.S. Electrical Engineering 1992	O	NTT	FT	13	13	11	NA	L	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, Bachelor of Science in Engineering Physics

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
Eric Butcher	Ph.D. Mechanical Engineering 1997	ASC	T	FT	1	14	5	NA	H	H	L
Chunpei Cai	Ph.D. Aerospace Engineering 2005	AST	TT	FT	0	4	4	NA	M	H	L
Vincent Choo	Ph.D. Composite Materials 1982	ASC	T	FT	3	29	27	NA	M	M	L
Edgar G. Conley	Ph.D. Engineering Materials 1986	ASC	T	FT	4	36	34	NA	M	H	M
Gabe Garcia	Ph.D. Mechanics of Materials 1996	ASC	T	FT	0	16	16	NA	L	L	H
Joe Genin	Ph.D. Engineering Materials 1963	P	T	FT	9	46	27	NA	H	H	H
Harry C. Hardee	Ph.D. Mechanical Engineering 1966	P	T	FT	14	22	21	NA	L	M	M
Young S. Lee	Ph.D. Mechanical Engineering 2006	AST	TT	FT	5	6.5	4	NA	H	H	L
Ian Leslie	Ph.D. Mechanical Engineering 1984	ASC	T	FT	0	28	28	NA	L	L	L
Ou Ma	Ph.D. Mechanical Engineering 1991	P	T	FT	11	10	10	NA	H	M	M
Young Ho Park	Ph.D. Mechanical Engineering 1994	ASC	T	FT	2	13	12	NA	H	H	M
Bashar Qawasmeh	Ph.D. Mechanical Engineering 2012	AST	NTT	FT	0	1	1	NA	L	L	L

Amit Sanyal	Ph.D. Aerospace Engineering 2004	AST	TT	FT	0	7	2	NA	H	H	M
Ma'en Sari	Ph.D. Mechanical Engineering	AST	NTT	FT	0	2	2	NA	L	L	L
Banavara N. Shashikanth	Ph.D. Aerospace Engineering 1998	ASC	T	FT	2	21	21	NA	L	L	L
Fangjun Shu	Ph.D. Mechanical Engineering 2005	AST	TT	FT	0	2	2	NA	M	L	L
Mark E. Stevens	B.S. Mechanical Engineering 1990	I	NTT	PT	6	2	2	NA	L	L	L
Mingjun Wei	Ph.D. Theoretical & Applied Mechanics	ASC	T	FT	0	0	6	NA	H	H	L
Edward A. Berndt	M.S. Mathematics	A	NTT	PT	0	2	5	NA	L	L	L
Nathanael Greene	M.S. Mechanical Engineering 2004	A	NTT	PT	7	2	2	NA	L	L	L
James F. Vennes	IT Support	O	NTT	PT	0	2	10	NA	L	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.c. Faculty Qualifications – Department of Electrical Engineering, Bachelor of Science in Engineering Physics

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
Deva Borah	Ph.D. Information Sciences 2000	ASC	T	FT	0	19	12	NA	M	H	L
Sukumar Brahma	Ph.D. Electrical Engineering 2001	AST	TT	FT	2	9	5	NA	H	H	M
Laura Boucheron	Ph.D. Electrical and Computer Engineering 2008	AST	TT	FT	2	1	1	NA	L	H	L
Sang-Yeon Cho	Ph.D. Electrical and Computer Engineering 2003	AST	TT	FT	0	5	5	NA	M	H	L
Jeanine Cook	Ph.D. Electrical Engineering 2002	ASC	T	FT	7	7	9	NA	M	H	L
Charles Creusere	Ph.D. Electrical Engineering 1993	P	T	FT	10	11	11	NA	H	H	L
Muhammed Dawood	Ph.D. Electrical Engineering 2001	ASC	T	FT	6	14	7	NA	L	M	L
Philip DeLeon	Ph.D. Electrical Engineering 1989	P	T	FT	0	16	16	NA	L	M	M
Paul Furth	Ph.D. Electrical and Computer Engineering 1991	ASC	T	FT	5	17	17	NA	L	L	L
Hong Huang	Ph.D. Electrical Engineering 1994	AST	TT	FT	11	11	9	NA	M	M	L
Joerg Kliewer	Ph.D. Electrical Engineering 1999	AST	TT	FT	0	13	5	NA	H	H	L

Kwong Ng	Ph.D. Electrical Engineering 2005	P	T	FT	0	27	21	NA	L	H	L
Vojin Oklobdzija	Ph.D. Electrical Engineering 1982	P	T	FT	27	6	2	NA	H	H	H
Robert Paz	Ph.D. Electrical Engineering 1991	ASC	T	FT	2	21	21	NA	L	M	L
Krist Peterson	Ph.D. Electrical Engineering 1998	ASC	NTT	FT	6	20	27	NA	M	M	M
Nadipuram Prasad	Ph.D. Electrical Engineering 1989	ASC	T	FT	15	26	26	NA	L	M	L
Jaime Ramirez-Angulo	Ph.D. Electrical Engineering 1990	P	T	FT	0.5	29	22	NA	H	L	L
Steven J. Stochaj	Ph.D. Physics 1990	P	T	FT	3	32	32	NA	M	M	M
Liu Wenxin	Ph.D. Electrical Engineering 2005	AST	TT	FT	3	3	3	NA	L	H	L
Charles Boehmer	M.S. Electrical Engineering 1973	A	NTT	PT	39	12	12	NA	L	L	L

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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 Engineering, Bachelor of Science in Engineering Physics

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
Paul Anderson	Ph.D. Chemical Engineering 1987	ASC	T	FT	0	24	14	NA	L	M	L
Shuguang Deng	Ph.D. Chemical Engineering 1996	P	T	FT	12	9	9	NA	H	H	M
Abbas Ghassemi	Ph.D. Chemical Engineering 1991	P	T	FT	14	25	22	NA	M	L	H
Jessica Houston	Ph.D. Chemical Engineering 2005	AST	TT	FT	4	3	3	NA	H	H	L
Hongmei Luo	Ph.D. Chemical Engineering 2006	AST	TT	FT	3	3	3	NA	H	H	L
Martha Mitchell	Ph.D. Chemical Engineering 1996	P	T	FT	1	16	16	NA	H	H	L
David Rockstraw	Ph.D. Chemical Engineering 1989	P	T	FT	27	16	16	NA	H	M	H
Ken White	Ph.D. Civil Engineering 1970	P	NTT	FT	1	42	39	NA	M	L	M
M. Ginger Scarbrough	Ph.D. Structural Geology 1992	A	NTT	PT	3	0	3	NA	L	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 6-2.a. Faculty Workload Summary – Department of Physics, Bachelor of Science in Engineering Physics

Faculty Member (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	PHYS 395 (3) Fall 2011	27	55	18	10
Michaela Burkardt	PT	PHYS 213 (3) Fall 2011 PHYS 350 (3) Fall 2011 PHYS 214 (3) Spring 2012	90	0	10	21
Michael DeAntonio	PT	PHYS 304 (4) Fall 2011 PHYS 473 (3) Spring 2012	61	34	3	25
Michael Engelhardt	FT	None (sabbatical leave)	28	65	7	3
William Gibbs	PT	PHYS 476 (3) Fall 2011	40	30	30	10
Thomas Hearn	FT	PHYS 451 (3) Fall 2011	40	40	20	25
Stephen Kanim	FT	PHYS 216G (3) Fall 2011 PHYS 216G (3) Spring 2012 PHYS 450 (3) Spring 2012	40	50	10	25
Boris Kiefer	FT	PHYS 454 (3) Fall 2011 PHYS 305V (3) Spring 2012 PHYS 455 (3) Spring 2012	48	42.6	9.4	28
Gary Kyle	FT	PHYS 217 (3) Fall 2011	45	42.5	12.5	15
Heinz Nakotte	FT	PHYS 461 (3) Fall 2011 PHYS 488 (3) Fall 2011 PHYS 462 (3) Sp 2012	30	50	20	44
James Ni	FT	none	15	70	15	3
Vassilios Papavassiliou	FT	PHYS 491 (3) Fall 2011 PHYS 475 (3) Spring 2012	37.5	50	17.5	15

Stephen Pate	FT	PHYS 315 (3) Spring 2012 PHYS 315L (3) Spring 2012 PHYS 480 (3) Spring 2012	45	45	10	29
Jacob Urquidi	FT	PHYS 215G (3) Fall 2011 PHYS 215G (3) Fall 2011	51	44	5	18
Igor Vasiliev	FT	none	40	50	10	13
Stefan Zollner	FT	PHYS 215G (3) Spring 2012	35	15	50	20
Tarlochan Dhillon	PT	PHYS 215G (3) Spring 2012	100	0	0	6
George Goedecke	PT	PHYS 495 (3) Spring 2012	100	0	0	6
Peter de Châtel	PT	PHYS 489 (3) Spring 2012	100	0	0	6
Chris Pennise	FT	PHYS 213GL (1) Fall 2011 PHYS 215GL (1) Fall 2011 PHYS 216GL (1) Fall 2011 PHYS 214GL (1) Spring 2012 PHYS 215GL (1) Spring 2012 PHYS 216GL (1) Spring 2012	90	0	10	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 (2011/12 academic year).
3. Program activity distribution should be in percent of effort in the program and should total 100%. Figures are for 2011 calendar year.
4. Indicate sabbatical leave, etc., under "Other."
5. Out of the total time employed at the institution (see text for explanation).

Table 6-2.b. Faculty Workload Summary – Department of Mechanical & Aerospace Engineering, Bachelor of Science in Engineering Physics

Faculty Member (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]	
Edward A. Berndt	PT	ME 328 (3) Fall 2011 AE 328 (3) Spring 2012	100	0	0	6
Chunpei Cai	FT	AE 419 (3) Fall 2011 AE 419 (3) Spring 2012	40	60	0	6
Vincent K. Choo	FT	ME 234 (3) Fall 2011 ME 345 (3) Fall 2011	30	60	10	6
Edgar G. Conley	FT	ME 326 (3) Fall 2011 ME 425 (3) Fall 2011 ME 449 (1) Fall 2011 ME 326 (3) Spring 2012 ME 425 (3) Spring 2012 ME 449 (1) Spring 2012	80	15	5	15
Gabe Garcia	FT	ME261 (4) Fall 2011 ME261 (4) Spring 2012	40	30	30	6
Joe Genin	FT	ME 237 (3) Fall 2011 ME 237 (3) Spring 2012	30	50	20	5
Nathanael Greene	PT	ME 328 (3) Fall 2011	100	0	0	3
Harry C. Hardee	FT	ME 341 (3) Fall 2011 ME 341 (3) Spring 2012	30	50	20	6
Young S. Lee	FT	AE 364 (3) Fall 2011 AE 363 (3) Spring 2012 AE 364 (3) Spring 2012	30	60	10	9

Ian Leslie	FT	ME 240 (3) Fall 2011 ME 240 (3) Spring 2012 AE 362 (3) Spring 2012	30	30	40	9
Ou Ma	FT	AE 424 (3) Fall 2011 AE 424 (3) Spring 2012	25	60	15	6
Young Ho Park	FT	ME 426 (3) Fall 2011 ME 427 (3) Fall 2011 ME 426 (3) Spring 2012 ME 427 (3) Spring 2012 AE 428 (3) Spring 2012	40	45	15	21
Bashar Qawasmeh	FT	AE 447 (3) Spring 2012	100	0	0	3
Amit Sanyal	FT	AE 362 (3) Fall 2011 AE 561 (3) Spring 2012	30	50	20	6
Ma'en Sari	FT	ME 236 Fall 2011 ME 236 (3) Spring 2012 ME 341 (3) Spring 2012	30	60	10	9
Banavara N. Shashikanth	FT	ME 338 (3) Fall 2911 ME 338 (3) Spring 2012 AE 339 (3) Spring 2012	30	60	10	9
Fangjun Shu	FT	AE 439 (3) Fall 2011 AE 439 (3) Spring 2012	30	65	5	6
Mark E. Stevens	PT	ME 102 (1) Fall 2011 ME 102 (1) Spring 2012	100	0	0	2
James F. Vennes	PT	ME 159 (2) Fall 2011 ME 159 (2) Spring 2012	100	0	0	3
Mingjun Wei	FT	AE339 (3) Fall 2011 ME 533 (3) Spring 2012	30	65	5	6

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3. Program activity distribution should be in percent of effort in the program and should total 100%. Figures are for 2011 calendar year.
4. Indicate sabbatical leave, etc., under "Other."
5. Out of the total time employed at the institution (see text for explanation).

Table 6-2.c. Faculty Workload Summary – Department of Electrical Engineering, Bachelor of Science in Engineering Physics, New Mexico State University

Faculty Member (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]*	
Deva Borah	FT	EE 210 (4) Fall 2011	50	30	20	4
Charles Boehmer	PT	EE 461 (3) Fall 2011 EE 460 (3) Spring 2012	100	0	0	6
Laura Boucheron	FT	EE 314 (4) Spring 2012	35	60	5	4
Sukumar Brahma	FT	EE 391 (4) Fall 2011	40	50	15	4
Sang-Yeon Cho	FT	EE 425 (3) Fall 2011 EE 380 (4) Spring 2012	35	60	5	7
Jeanine Cook	FT	EE 419 (3) Fall 2011	25	50	25	3
Charles Creusere	FT	EE 312 (3) Fall 2011 EE 418 (3) Fall 2011 EE 210 (4) Spring 2012 EE 419 (3) Spring 2012	25	50	25	14
Muhammed Dawood	FT	EE 351 (4) Fall 2011 EE 351 (4) Spring 2012 EE 454 (3) Spring 2012	30	60	10	16
Philip DeLeon	FT	EE 395 (3) Fall 2011 EE 419 (3) Fall 2011	25	40	35	6
Paul Furth	FT	EE 418 (3) Fall 2011 EE 486 (3) Fall 2011 EE 201 (3) Spring 2012 EE 419 (3) Spring 2012	55	35	10	13
Hong Huang	FT	EE 260 (4) Fall 2011 EE 161 (4) Spring 2912	35	55	10	8

Joerg Kliewer	FT	EE 312 (3) Spring 2012	30	60	10	3
Kwong Ng	FT	EE 310 (3) Fall 2011 EE 310 (3) Spring 2012	50	40	10	6
Vojin Oklobdzija	FT	EE 418 (3) Spring 2012	0	25	75	3
Robert Paz	FT	EE 314 (4) Fall 2011 EE 260 (4) Spring 2012	30	55	15	8
Krist Petersen	FT	EE 161 (3) Fall 2011 EE 418 (3) Spring 2012	50	0	50	6
Nadipuram Prasad	FT	EE 201 (3) Fall 2011	45	45	10	3
Jaime Ramirez- Angulo	FT	EE 380 (4) Fall 2011 EE 485 (3) Spring 2012	30	60	10	7

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2. For the academic year for which the self-study is being prepared (2011/12 academic year).
3. Program activity distribution should be in percent of effort in the program and should total 100%. Figures are for 2011 calendar year.
4. Indicate sabbatical leave, etc., under "Other."
5. Out of the total time employed at the institution (see text for explanation).

Table 6-2.c. Faculty Workload Summary – Department of Chemical Engineering, Bachelor of Science in Engineering Physics, New Mexico State University

Faculty Member (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 Anderson	FT	ChE 470 (3) Fall 2011 ChE 305 (3) Spring 2012 ChE 474 (3) Spring 2012 ChE 376 (3) Spring 2012	60	20	20	18
Shuguang Deng	FT	ChE 306 (3) Fall 2011 ChE 307 (3) Spring 2012	35	55	10	6
Abbas Ghassemi	FT	ChE 412 (3) Fall 2011 ChE 311 (3) Spring 2012	30	60	10	6
Jessica Houston	FT	ChE 111 (3) Fall 2011 ChE 491 (3) Fall 2011	35	55	10	6
Hongmei Luo	FT	ChE 301 (3) Spring 2012	35	55	10	3
Martha Mitchell	FT	ChE 302 and lab (4) Fall 2011	40	10	50	4
David Rockstraw	FT	ChE 201 (4) Fall 2011 ChE 452 and lab (4) Fall 2011 ChE 490 (1) Fall 2011 ChE 352L (1) Spring 2012 ChE 455 and lab (4) Spring 2012	80	10	10	15
M. Ginger Scarbrough	PT	ChE 361 (3) Fall 2011 ChE 361 (3) Spring 2012	100	0	0	6

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3. Program activity distribution should be in percent of effort in the program and should total 100%. Figures are for 2011 calendar year.
4. Indicate sabbatical leave, etc., under "Other."
5. Out of the total time employed at the institution (see text for explanation).

Criterion 7: Facilities

Engineering Physics

Bachelor of Science in Engineering Physics

Self-Study Report

New Mexico State University

June 2012

CRITERION 7. FACILITIES

A. Offices, Classrooms and Laboratories

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

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

Graduate students have offices either in large office suites broken up into cubicles, or they share smaller faculty-sized offices in various locations in the building.

Classrooms: **T**he Department of Physics conducts almost all of its lecture classes in four classrooms in *Gardiner Hall*. All four classrooms have multi-media capabilities.

The largest classroom, *Gardiner 230*, seats about 100 students; this classroom is used for the large engineering classes, such as *PHYS 215* and *216*. The next largest, *Gardiner 229*, seats about 60 students; this is used for the smaller more intensive classes *PHYS 213*, 214*, 217*, and *315*. *Gardiner 218A*, which seats about 20 students, is used for upper-division classes like *PHYS 454*, *455*, *461*, *462*, *480*, etc. *Gardiner 218* is a highly flexible multi-media classroom with circular tables and multiple PC displays, more suited for a workshop atmosphere and remote instruction, and it is used for instructional seminars and other somewhat informal instructional support functions.

Laboratories: The Department of Physics supports a variety of instructional laboratories. Four large labs, Gardiner 104, 108, 204, and 206 (each about 1250 sq. ft.) are used for the *Introductory Laboratory* classes *PHYS 213L*, *214*L, *215L*, *216L*, and *217L*. The *Modern Physics Laboratory*, *PHYS 315L*, is run in a dedicated lab space, Gardiner 132, which is about 800 sq. ft. in size. The Advanced Physics Laboratory, *PHYS 475*, is operated in several laboratory spaces throughout Gardiner Hall, some of which are also research laboratories. In the advanced *PHYS 315L* and *475* labs, the students are required to do some experimental design work, after they have become familiar with the apparatus available. We also have dedicated space for *Physics Education Research* and *Physics Demonstrations* (Gardiner 142), which was recently used as a laboratory for a capstone project for several Engineering Physics majors.

Student Societies: The Department of Physics has two very active chapters of the *Society of Engineering Physics (SEPh)* and the *Society of Physics Students (SPS)*, a national organization operated by the American Institute of Physics. 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.

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

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

Office Number	Room Allocation	Occupant Name	Capacity	Size (sq.ft.)	Primary Purpose
050	Materials Science Lab	Dr. Bruce	0	224	Research
054	Department Wet Lab	Dr. Zollner	0	186	Research
055	Res. Assist. Office	6 RAs	6	382	Office
057	Research Lab	Dr. DeAntonio	0	188	Research
058	Materials Science Lab	Dr. Urquidi	0	157	Research
060	X-RAY Lab	Dr. Urquidi	0	1559	Research
062	Experimental Lab	Dr. Urquidi	0	92	Research
063	Faculty Office	Dr. Urquidi	1	93	Office
065	Adv. Phys. Lab		10	367	Teaching Lab
065A	Radioactive Storage	Dr. Pate	0	70	Support
066	Adv. Phys. Lab		10	682	Teaching Lab
069	Materials Science Lab	Dr. Urquidi	0	183	Research
102	Emeritus Faculty Office	Dr. Goedecke	1	160	Office
103	Emeritus Faculty Office	Dr. Armstrong	1	119	Office
104	Physics Teaching Lab		20	885	Teaching Lab
106	Class Lab Storage		0	368	Teaching Lab
108	Physics Teaching Lab		20	1050	Teaching Lab
125	Student Society Room	SPS	2	283	Office
131	Physics Teaching Lab		20	496	Teaching Lab
132	Modern Physics Lab		3	286	Teaching Lab
132A	Modern Physics Lab		7	309	Teaching Lab
132B	Modern Physics Lab		0	97	Teaching Lab
142	Outreach		0	428	Outreach
201	Grad Assistant Office	4 TAs	1	151	Office
202	Grad Assistant Office	4 TAs	1	160	Office
203	Emeritus Faculty Office	Dr. Higbie	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	Departm. Techn.	Ms. Pennise	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	Mrs. 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. DeAntonio	1	130	Office
250A	Closet		0	31	Office
251	College Faculty Office	Dr. Mi. Burkardt	1	130	Office
254	Faculty Office	Dr. Zollner	1	183	Office
255	Faculty Office	Dr. Urquidi	1	189	Office
256	Faculty Office	Dr. Gibbs	1	193	Office
256A	Faculty Office	Dr. Engelhardt	1	185	Office
258	Faculty Office	Dr. Kanim	1	193	Office
258A	Faculty Office	Dr. Ma. Burkardt	1	185	Office
259	Faculty Office	Dr. Vasiliev	1	187	Office
259A	Atmospheric Optics	Dr. Bruce	1	187	Office
259B	Faculty Office	Dr. Bruce	1	177	Office
260	Atmosph. Optics Lab	Dr. Bruce	0	561	Research
261	Conf. Room & Library		20	835	Office
264	Computer lab & SEPh		14	835	Teaching Lab
265	Optics Research Lab		0	747	Research
266	Office Storage		0	181	Support
267	Post Doc Office	Dr. Jelinek	1	131	Office
268	Emeritus Faculty Office	Dr. Pinnnick	1	141	Office
352B	Faculty Office	(Dr. Wang)	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. Ni	1	193	Office
359	Technician Office	Mr. Tawalbeh	1	167	Office
361	Grad Assistant Office	6 RAs	6	573	Office
362	Research Lab	Dr. Nakotte	0	568	Research
363	Grad Assistant Office	6 RAs	6	568	Office
364	Nuclear Physics Lab	Dr. Pate	0	761	Research
365	Geophysics Res. Lab	Dr. Ni	0	571	Research
366	Geophysics Res. Lab	Dr. Hearn	0	165	Research

B. <u>Computing Resources</u>

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 15 computer workstations in our computer laboratory, 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. Physics and Engineering Physics majors can have accounts on these computers for use in other projects. For example, students in the PHYS 315L advanced lab are expected to use a variety of computing tools to collect and analyze data.

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.

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 the usage of the equipment, whenever it is deemed necessary and appropriate. While there are typically negligible (or only minor) safety concerns within the introductory 200-level laboratories, the higher-level laboratories (PHYS 315L and PHYS475) do requires special instructions to protect the student from possible injury. For example, some of the experiments in PHYS 475 utilize ionizing radiation, such as X-rays. In general, students will be given specialized training and safety material on the proper and safe way to use potentially harmful equipment.

New Mexcio State University's *Environmental Health & Safety (ES&H) office* (17 staff members) offers varies safety trainings & programs, publishes safety policies and reviews safety procedures for all of the campus facilities, including research and instructional laboratories. For laboratories that pose potential safety hazards, students are required to review the safety materials, obey with the safety requirements (e.g. safety glasses are a 'must' for any of the Chemistry labs) and take a separate training course, if needed. Documentation and other information from NMSU's ES&H office can be reviewed at http://www.nmsu.edu/safety/.

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

Within the Department of Physics students are offered computing classes, such as *PHYS 150* (optional) and *PHYS 476* (elective) that are available to train students in the use of computers in addressing physics problems. Moreover, all of the Engineering Physics students take computing courses in Engineering as part of the engineering portion of their degree requirements.

D. <u>Maintenance and Upgrading of Facilities</u>

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 ~13 M$. During that period, the building was completely vacated, and all offices and laboratories (both research and instructional) were temporarily re-located to other buildings on the NMSU campus. As part of the renovation, all classrooms and offices received new furniture and A/V equipment. Moreover, new desktop computers and color printers (or scanner/fax/printer units) were purchased for all faculty members. NMSU President Coutoure, Provost Wilkins, and Arts &Science Dean Slaton visited Gardiner Hall to establish that the renovation resulted in a building suitable for its purpose, i.e. to house both the Departments of Physics and the Department of Geology. The heads from both departments have been meeting with Arts and Science's Associate Dean Jeff Brown, the NMSU Office of Facilities & Services on a regular basis to plan completion of some remaining items of the renovations, such as a fume hood for a departmental wet lab, ultrapure water for a biophysics lab, non-contact cooling water for the X-ray scattering laboratory, key-card access for the room of the Society of Physics students as well as for the instructional laboratories.

The Department of Physics has two exempt staff members (Chris Pennise, MS in Electrical Engineering, and Tarek Tawalbeh, MS in Physics) who are charged with maintaining and upgrading the instructional laboratories and the computational facilities. They perform minor repairs, upgrades, and maintenance (often in collaboration with undergraduate students in physics or engineering physics), order parts and supplies, and install new equipment. Costs are paid by the Physics Department's operational funds (described in *Criterion 8*).

Twice a year, the institution solicits requests *for Equipment Renewal and Replacement* from the departments. Also, in the Fall semester, there is a call for requests to distribute Student Equipment Maintenance Fees. These funds can be used for equipment, software, maintenance, and supplies. Requests are routed from the Department of Physics through the College of Arts and Sciences to the central administration. Typical allocations to the Department of Physics have been around 10 k$ per year in recent years.

Ms. Pennise and the Physics Department Head manage the NMSU inventory in the Department of Physics. The department has 571 inventory items for research and instructional purposes. These items are physically located and their barcodes are scanned once a year. Exceptions (items not found and scanned) are reported to the NMSU's *Board of Regents*. By state law, inventory items are defined as items with an acquisition cost of USD 1000 or higher, regardless of age or depreciation. NMSU's risk management includes property insurance with a 5000-dollar deductible for any theft and a 1000-dollar deductible for any loss due another covered occurrence.

To purchase equipment items, the Department of Physics requests funds for specific items from the central administration through the College of Arts and Sciences twice per year. Such items can also be purchased from the department's operational or foundation funds, on a limited basis. The *Dr. Horace Coburn Physics Fund* (annual earnings about 8 K$ per year) is used to purchase or build lecture demonstration or display equipment. The funds can also be used for engineering physics capstone projects, if the purpose of these projects is to build demonstration of display equipment. One recent example of such a capstone project is the coupled physical pendulum designed by Dr. Kanim and students. Funds for instructional equipment can also be requested from government funding agencies, such as the *National Science Foundation (NSF)*. A previous *NSF* grant paid for equipment items in our instructional mechanics lab. The Physics Department just received approval from the *Vice President for Research* to submit a *STEP (STEM talent expansion program)* proposal to *National Science Foundation*. We anticipate that this proposal will contain some funds for facilities and equipment. Finally, many of the faculty members engaged in the Engineering Physics program have research grants which pay for equipment and facilities. Usually, these research laboratories can be used for undergraduate instruction on a limited case-by-case basis.

Repairs and maintenance of multimedia equipment in the classrooms are maintained by NMSU *Information and Communication Technologies (ICT)*. The cost of these repairs is paid by the Physics Department's operational funds. The NMSU *Office of Facilities and Services (OFS)* provides janitorial services daily, which is adequate considering the use of the building. OFS 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 OFS. Once a year, each department can request *Building Repair and Renewal (BRR) funds* from the central administration through the College of Arts & Sciences. This option has not been exercised recently, because *Gardiner Hall* just underwent a 13 M$ renovation. It can be exercised in future years, for example for new lecture hall seating, instructional laboratory renovation, or other items attached to the building.

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

E. Library Services

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

The Library is housed in two large buildings (*Zuhl* and *Branson*) on the central campus. *Branson* contains an extensive scientific collection. Support for journals is good, in both print and electronic access, although there is a steady long-term trend of cuts in journal support. The library maintains a large collection of 1,829,158 items. Of those, about 10.8% comprise the Engineering collection.

Undergraduate students may borrow up to 50 books at a time. Two additional renewal periods are typically available for all faculty and student loans, which may be requested online. Media materials and bound journals have more restricted loan periods.

The majority of the library's resources are online, accessible via the library's web page http://lib.nmsu.edu/article.shtml. The figure below shows the total number of full-text serial titles users have access to via the library's subscriptions and/or database aggregators. Resources may be accessed on campus or remotely by proxy server verification of user status. In addition to general academic databases that serve the needs of the entire campus, the library provides access to many databases geared specifically toward the research needs of Engineering students and faculty, such as *SciFinder* and *Web of Science.*

The Library participates in inter-library loan services. *Request It!* includes interlibrary loan, document delivery, and related delivery and pick-up services http://lib.nmsu.edu/depts/accserv/ids.shtml. Students, faculty, and staff seeking access to information, whether owned by the NMSU Library or another library or organization, may take advantage of *Request It!* Articles and other documents are delivered electronically to the user's account whenever possible. In most cases, *Request It!* is available at no charge to the user. Turnaround times vary depending upon the time of the semester and the availability of the item.

Faculty may place library or personally-owned materials on *Reserve* for improved access to course-related materials. Access and loan periods are determined by the instructor. Whenever possible, materials are scanned, linked, downloaded, or streamed and made accessible through *DocuTek*, the Library's web-based electronic reserves service http://lib.nmsu.edu/depts/accserv/reserves.shtml. Reserves and other library staff can assist instructors who wish to create persistent links to electronic library resources in their learning management system (LMS) course page(s).

The first floors of both *Branson* and *Zuhl* were recently redesigned to provide more comfortable and effective learning spaces, offering a mix of quiet individual study areas and group work spaces that feature increased desktop areas, electrical outlets, and mobile tables, chairs and whiteboards to facilitate collaborative work. There are now 68 computers in *Zuhl* Library and 42 in *Branson*, as well as wireless connectivity for mobile devices throughout the facilities. Both libraries circulate DVD players and other peripherals, and have media viewing equipment available on-site. Each building offers networked printers, two black and white photocopiers, and two, no-cost scanning stations where students can scan and e-mail materials or save the images to a flash drive. Branson Library has digital microform machines available which allow users to save or deliver content electronically. *Zuhl* has a color photocopy machine.

The library's Reference and Research Services department has 16 full-time staff members; all are familiar with the collection and resources, and available to answer reference requests that come to the desk during operating hours. Questions requiring more in-depth work or subject knowledge are referred to the Engineering Librarian for a personal consultation.

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 2012-2013 APPM Section II.G.6.b.(1)).

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

On many occasions, our Engineering Physics students did indicate that needed facilities in the participating engineering departments rank from ‘adequate’ to ‘excellent’, especially for the instructional laboratories.

Criterion 8: Institutional Support

Engineering Physics

Bachelor of Science in Engineering Physics

Self-Study Report

New Mexico State University

June 2012

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

This highly interdisciplinary degree has been approved by the NMSU Board of Regents and is supported by the central administration. Provost Wilkins is very supportive of interdisciplinary programs. Both colleges support the program and provide leadership and advice, for example through interactions with the external Engineering Physics Advisory Board, with the Physics Department Head, and through the Engineering Physics Committee (described later).

At the departmental level, leadership of the BS in Engineering Physics program is shared between the Physics Department Head (Dr. Stefan Zollner), the Engineering Physics Program Head (Dr. Heinz Nakotte), and the Engineering Physics Program Committee (Dr. Nakotte, Dr. Hearn, Dr. Pate, Dr. DeAntonio, Dr. Vasiliev, Dr. Dawood, Dr. Andersen, Dr. Park, and Ms. Fernandez).

The Department Head attends all department head meetings (and similar events) in the College of Arts & Sciences and as many as possible in the College of Engineering. When he is absent from campus, he appoints an acting department head. In cases of scheduling conflicts between both colleges, he is represented by the Engineering Physics program head or a member of the Engineering Physics Committee. This arrangement allows complete tie-in of the Department of Physics and the Engineering Physics program in both colleges. The role of the academic department head is described in the NMSU Policy Manual, especially Section 5.45.20. The Physics Department Head serves at the discretion of the Dean of the College of Arts & Sciences, with the concurrence of the executive vice president and provost. The Physics Department Head is evaluated annually by the Dean of the College of Arts & Sciences, with a more detailed review every three to five years. Items most relevant to the leadership of the Engineering Physics program are described below.

Responsibilities of the Physics Department Head include the following: academic leadership in teaching, research, and outreach; departmental collegiality; managing the budget, meeting reporting requirements to the institution and both colleges; scheduling of courses to meet the requirements of students enrolled in undergraduate and graduate programs; 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, external representation of the department (college- and institution-wide, national societies, constituents, national laboratories, local industry, government agencies, alumni, prospective students and their parents), ruling on academic and personnel appeals and grievances, assisting and advising of students, staff, and faculty with NMSU policies and procedures. The Department Head also performs all exit interviews with engineering physics students and reports his findings to the Engineering Physics Program Committee. He also carries out alumni surveys.

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

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

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

All departmental committees regularly update the entire physics faculty at departmental faculty meetings, which are held at least once a month. Special physics faculty meetings are held for important topics as needed, for example to review the Department's Promotion and Tenure and other governance documents, to discuss candidates interviewed for an open faculty position, to discuss continuous improvement of outcomes and objectives of educational programs, to plan the strategy of the department for future directions, to decide on committee assignments, or to review the progress of undergraduate and graduate students towards degree completion.

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 chair.

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

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

B. Program Budget and Financial Support

1. 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.

The recurring total budget of the NMSU Department of Physics for the 2011/12 fiscal year (July 1st to June 30th) has four components, as listed below. The Department of Physics has six degree options, including BS and BA in Physics, BS in Engineering Physics, MS in Physics, Ph.D. in Physics, and MS in Physics with a *concentration in Space Physics*. Expenditures towards these different degrees are not budgeted separately. The Department of Physics also teaches general education courses for about 1000 NMSU students each year.

The budget of the Department of Physics has been very stable (almost flat) for the past decade, indicating strong continuous institutional support. Students in the Engineering Physics program take core courses in physics and in one engineering discipline. Usually, these courses have low enrollment and therefore no additional instructional expenses are needed to offer the Engineering Physics program. The biggest budget item for Engineering Physics is the cost of administration as a separate degree program.

There is considerable synergy between the physics and engineering physics programs. Only in this combination can a sufficient number of students be reached to offer upper-division physics courses. (10 or more students are needed to offer an undergraduate course.) Engineering physics students also indicate a stronger affinity with physics than with engineering. Therefore, these two degree programs should be housed in the same academic department. Since NMSU is a small institution, the two programs would not be viable as separate programs.

Recurring budget items in the Department of Physics:

- The Instructional and General (I&G) budget, which consists of *State of New Mexico* funds, is currently at 1.56 M$ per year (down from 1.70 M$ in the 2008/09 fiscal year). The items in this budget contain the salaries of the Department Head and staff (229 k$, down from 269 k$), the faculty salaries (985 k$, down from 1051 k$), the graduate teaching assistant salary pools (262 k$, down from 297 k$), and departmental operational funds (80 k$, flat since the 2008/09 fiscal year).
- Physics faculty members conduct research funded by external agencies (NSF, DoE, Army, Air Force, NASA, etc.) with annual expenditures of approximately 1.5 M$. 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 engineering physics undergraduate students. These undergraduate research funds are supplemented with small grants 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 Department. After subtracting the departmental portion of startup commitments and cost share, the department receives about 15 to 20 k$ annually. 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 60 k$ per year in earnings from NMSU Foundation endowed accounts (totaling about 1.5 M$). These funds are used to pay undergraduate student scholarships (scholarships of USD 750 each for 20 students, totaling 15 k$), hosting physics colloquium speakers, meal and entertainment expenses of candidates interviewing for faculty positions, banquets or picnics for students, faculty, and staff at the end of each semester, named research professorships (Gardiner Professorship), and summer research support for graduate students.

The Department of Physics I&G budget is established annually by the institution through the College of Arts & Sciences. Despite recent cuts in state support for the institution and changes in institutional priorities through reallocation of faculty and graduate teaching assistantship lines, the total I&G funds in the Department of Physics have only been reduced by about 8% since 2008/09. See TABLE 8.1 for details. Despite overall budget pressures, the institution has continually supported the Department of Physics, for example by renovating Gardiner Hall, which houses the Department of Physics and the Geological Sciences Department, by hiring a new Academic Department Head, replacing the retiring Fiscal Monitor, providing permanent funds for two College Associate Professors (teaching faculty), and by approving a new junior tenure-track faculty hire. Our undergraduate programs in physics and engineering physics compare favorably in quality, enrollment, and graduation rates with others in the Rio Grande Valley (University of Texas at Brownsville, University of Texas – Pan American, University of

Texas at El Paso, New Mexico Institute of Mining and Technology) or in rural West Texas (Texas Tech University, Texas A&M Kingsville, Angelo State University, West Texas A&M University, Abilene Christian University, McMurry University).

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

Category	FY 01/02	FY 03/04	FY 05/06	FY 08/09	FY 09/10	FY 10/11	FY 11/12
Operational Funds	76,270	76,270	76,270	80,379	80,379	80,649	80,649
Faculty Salaries	992,947	1,019,978	1,088,768	1,051,328	1,061,889	983,859	985,159
Staff Salaries	~250,000	~250,000	~250,000	268,566	209,523	233,345	229,067
Teaching Assistants	242,607	246,347	265,728	297,401	297,401	262,413	262,413
F&A Return	30,499	38,673	20,000	~15,000	~15,000	~15,000	~15,000
Endowments	~60,000	~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 commitments (faculty start-up or mandatory cost-share). The share returned to the Department of Physics was reduced from 24.5% to 16% in the 2004/05 fiscal year. Earnings from Foundation accounts are based on the 1.5 M$ principal and can vary with the annual return on investments distributed by the Foundation.

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

- The College of Arts & Sciences and the central administration (through enrollment management) provide funds for temporary instructors (including graduate teaching assistants) during the fall and spring semester and over the summer. Salary savings from faculty on one-year sabbaticals, on leave, or from research course buy-outs are returned to the College of Arts & Sciences. In the 2011/12 fiscal year, the Department of Physics returned 65 k$ to the College of Arts & Sciences as salary savings and received 141 k$ for temporary instructors, resulting in additional one-time I&G funds of 76 k$.
- Twice a year, the institution solicits requests for Equipment Renewal and Replacement from the Department. Also, in the fall semester, there is a call for requests to distribute Student Equipment Maintenance Fees. These funds can be used for equipment, software, maintenance, and supplies. Requests are routed from the Department of Physics through the College of Arts & Sciences to the central administration. Typical allocations to the Department of Physics have been around USD 10,000 per year recently.
- The physics faculty voted not to request approval for additional enrollment-based course fees for our physics laboratory from the central administration, to avoid additional financial burdens for our NMSU students.

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

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

The Department of Physics had I&G funds of about 262 k$ for 15.4 half-time equivalent Graduate Teaching Assistants in the 2011/12 fiscal year (fall and spring). Most of these teaching assistants are assigned to teach general-education laboratory sections. Each semester, the Department of Physics teaches laboratory sections for about 650 students. Each teaching assistant also works in the physics tutoring center for about 2-3 hours per week to assist students with their general-education physics homework. All international students assigned as laboratory instructors have passed the International Teaching Assistant screening. (Students who fail the ITA screening must successfully complete a communication course before they can teach a lab section. To encourage quick academic progress, such students have to enroll in three physics courses and the communication course for a total of 12 credits. The Department of Physics pays 50% of the tuition for the communication course.) These graduate laboratory instructors are trained by the Department of Physics in an orientation session at the beginning of the semester. (The responsibility for hosting this session rests with the Graduate Physics Program Head, Dr. Papavassiliou). Day-to-day supervision for the lab TAs is provided by the Physics lab coordinator and instructor, Ms. Christine Pennise.

International teaching assistants who failed the International TA screening exam (and must be enrolled in the communication course) are usually assigned as graders. Each TA has responsibility to grade for three courses. In the spring of 2012, four half-time equivalent graders provided instructional grading support for a total of 12 courses. Since there are not enough graders for all undergraduate courses, some instructors are required to use an online homework system (usually Mastering Physics) in their large lower-division general-education courses.

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

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

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

3. 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.

The two-year renovation of Gardiner Hall (home of the Department of Physics and the Geological Sciences Department) was concluded in the summer of 2010. This renovation included new furniture for faculty offices, classrooms, and student lounges. All classrooms were equipped with a computer, a ceiling-mounted projector, blackboards or white boards, a document camera, a DVD and VCR combo player, and a stereo sound system (standard NMSU smart-room design). One classroom was designed for studio-style and peer-instruction learning based on the latest results from physics education research. This PER classroom is used for supplemental instruction in lower-division courses. Each faculty and staff member received a new computer and printer. Engineering physics students have access to the building during evening and weekend hours with proximity cards. They often meet to study or work on homework problems in the engineering physics student lounge (which is also used as our computational physics classroom a few times a week in the afternoon during the fall semesters). The renovation also provided high-quality space for research laboratories, but no laboratory equipment for instructional or research purposes.

The costs for infrastructure repairs (especially maintenance, supplies, and repairs for computer and audiovisual equipment, furniture, appliances, photocopier and printers) and minor facility improvements (such as new network drops, power outlets for laboratories, theft prevention devices, etc) are paid from the departmental operations budget.

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

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

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

In exit interviews, students generally express satisfaction with our institutional resources dedicated to engineering physics. Nevertheless, they mention two resource issues that might be improved.

(1) More capstone design courses should be offered by physics faculty. This requires new faculty lines with significant start-up funds for experimental research in Gardiner Hall. These new faculty will also provide opportunities for undergraduate research by physics and engineering physics students. The College of Arts & Sciences understands this issue and has just approved a new faculty hire in experimental nuclear physics. Our request for another faculty line in experimental materials physics was forwarded to the Provost's office.

(2) Students are not satisfied with the advanced physics laboratory course (PHYS 475), because it uses mostly obsolete equipment. This concern is known to the department and we are seeking to improve our advanced physics laboratory over time.

C. Staffing

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

The Department of Physics currently has 12.5 full-time equivalent tenured faculty members, including the Physics Department Head. At present, there are no tenure-track faculty members currently in the department. The Physics Department Head teaches one half of the average teaching load for the department, reducing the number of tenured faculty instructors to 12 FTE. There are also two half-time College-track (teaching) faculty members. When combined, these 13 FTE faculty instructors provide adequate teaching, advising, and assessment support for the engineering physics program. Required courses are offered at least once per year and our students can graduate in four years, provided they are ready for calculus in their first semester.

The Department of Physics also has three full-time staff members on campus. Loretta Gonzalez is the (non-exempt) Administrative Assistant. Her responsibilities include faculty and student hiring, student records, and student relations. Rosa Christensen is the (non-exempt) Fiscal Monitor. Most of her work is focused on administration of experimental research grants at the departmental level. She also supervises spending of departmental I&G funds. Finally, Ms. Pennise is the (exempt) lab coordinator. Since the Department of Physics has lost several faculty lines in recent years, we no longer have a sufficient number of faculty members to have the lower-division laboratories taught by faculty. Ms. Pennise therefore also acts as the laboratory instructor of record for 650 students each semester. She does an outstanding job teaching these labs and supervising our laboratory graduate teaching assistants. On the other hand, she is less likely to make laboratory curriculum improvements than a tenure-system faculty member. Formally, Elena Fernandez (a member of the Engineering Physics Program Committee) is also staff member (Specialist III) with the Department of Physics. However, she is presently being paid through a subcontract with Los Alamos National Laboratory (LANL), based there and fulfills duties at LANL.

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

NMSU exempt and non-exempt staff did not have a pay raise since the 2008/09 fiscal year. (The Administrative Assistant received a degree award supplement of $1200 annually when completing her BA in Spanish degree in 2009.) The lack of raises has made staff morale a challenge. Nevertheless, we have outstanding staff in the Department of Physics. The Department Head supports the staff by promoting a collegial climate in the department. The exempt lab coordinator has been receiving a small supplement to her staff salary for acting as the lab instructor for lower-division laboratory courses (due to an insufficient number of physics faculty members available to teach all our courses). Effective July 1st, 2012, the staff members are expected to receive a 2% pay increase (except for the fiscal monitor, who did not work for the university during the entire preceding 12-month period). While staff pay is generally low (even for Southern New Mexico), NMSU benefits (medical, dental, retirement, etc) are excellent in comparison with the private sector.

Training for the non-exempt staff members (Administrative Assistant and Fiscal Monitor) on NMSU business procedures (hiring procedures, record retention, general employee safety, etc) is made available by the institution. The lab coordinator traveled to the American Physical Society March meeting in Boston in February 2012, paid by the Department of Physics operational budget. This allowed her to visit lab equipment vendors in the conference exhibit, attend sessions on physics education research, and general physics talks of interest. NMSU also waives tuition for regular employees to enroll in a limited number of courses with permission of the supervisor, which enables employees to continuously improve their skills.

D. Faculty Hiring and Retention

1. Describe the process for hiring of new faculty.

Faculty lines that become vacant through retirements or resignations are returned to the Office of the Executive Vice President and Provost. Once a year, early in the spring semester, the academic departments submit requests for faculty lines to their college. (The Department of Physics submits such requests to the College of Arts & Sciences.) The colleges collect all requests and submit some of them to the Provost's Office for approval. Departments are notified during the summer if their line requests have been approved. When the department request new faculty lines, they also request start-up funds. 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. The *Mercer 2010 salary study* places the median salary for a new Assistant Professor of Physics at approximately 61 k$. A salary of 60 k$ was approved for our new hire in Experimental High-Energy Nuclear Physics for the 2012/13 academic year. There is concern in the Department of Physics that the budgeted salary will not be sufficient to attract a qualified candidate to this position, since nearby institutions have made recent assistant professor hires in physics at significantly higher salaries (70 k$ at University of New Mexico, 68 k$ at University of Texas at El Paso). A new NMSU salary study effective July 1, 2012, shows a median market salary of 64 k$ at research-intensive peer institutions. A study performed in the fall of 2011 by the Physics Department at Florida State University including 62 Ph.D. granting physics department around the nation shows a median new Assistant Professor Salary of 70 k$.

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. Attached to this form are a copy of the proposed ad and a description of the position. The Physics Department Head and the proposed chair of the search committee also meet with the Vice President for Research and the Associate Dean for Research in the College of Arts & Sciences to sign a firm commitment for start-up for the new faculty member. For the most recent hire to start in August 2012, an agreement was reached for a start-up of 241 k$. After the position request form has been fully approved, advertising can begin and a search committee is appointed by the Physics Department Head with concurrence of the Dean of Arts & Sciences. Typically, a search committee will have about 5 members, including one member from a different department and one member from a subfield of physics different from the new faculty member being sought.

The advertisement for the position, approved by Human Resources, is distributed as both a print ad (in Physics Today, typically) and as an online ad (in *Physics Today* online, and in a variety of jobs databases and email list-servers relevant to the field in question). Applicants are asked to provide a full CV, a statement of research interests, a statement of teaching philosophy, and a list of at least three references. The search committee reviews the applications and selects the best 3-4 candidates for interview. This short list is presented to the Physics Faculty and the Dean for approval.

During the interviews, each candidate will meet with the Dean (or an Associate Dean), the Vice President for Research, and small groups of faculty; present a Colloquium to the whole Department of Physics; and present a "pizza seminar" to a group of graduate students – the graduate students make written comments about each candidate.

Subsequent to the interviews, the search committee will meet and formulate a set of conclusions about the candidates based on their own experiences in the interviews, informal discussions with other faculty members, and the written comments of the graduate students. These conclusions are presented to a meeting of the Department of Physics faculty, and based on the outcome of that meeting a memo is written to the Dean expressing the conclusions of the Department. The Department Head, the Search Committee Chair then meet with the Dean to discuss which candidate will receive an offer.

2. Describe strategies used to retain current qualified faculty.

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

The College of Arts & Sciences also has a comprehensive awards program, including awards to stimulate research and 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 "College Awards" menu item on the sidebar. 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. James Ni and Dr. Heinz Nakotte) and from the institution as a whole (such as the *Distinguished Achievement Professorship* recently awarded to Dr. Matthias Burkardt and Dr. William Gibbs). Similarly, Dr. Heinz Nakotte received the institution's advising award at the fall 2010 faculty convocation.

If a faculty member with a strong record of performance receives an offer from another institution, NMSU will make an effort to retain this faculty member. The faculty member presents a written offer from another institution to the Department Head, who will make a recommendation to the Dean about retaining the faculty member. Retention incentives can include an increase in base salary; retention commitment (similar to start-up commitment) for students, summer salary, travel, equipment, supplies, etc; accommodation of a spouse or partner. The financial burden for such retention incentives is borne entirely by the College of Arts & 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.

The NMSU Board of Regents recognizes that faculty salaries at NMSU are well below market (especially for full professors) and that there has been no salary raise for faculty for a number of years, due to reductions in state formula funding for the institution. There will be a 2% salary raise pool for raises taking effect on July 1st, 2012.

The institution believes in differential rewards based on performance for students, staff, and faculty. To evaluate faculty performance, the faculty elect two tenured faculty members to consult with the Department Head about performance ratings (exceeds, meets, or does not meet expectations) in the areas of teaching, research, service, and outreach (if applicable). The overall performance rating, once approved by the Dean of the College of Arts & Sciences, will be considered in determining raises and other reward system elements. For example, for the current salary increase cycle, all faculty members with satisfactory performance over the past three years will receive an across-the-board 1% pay increase. In addition, a 0.85% raise pool was made available to the Department for performance based raises. The faculty approved a simple formula on how to distribute the additional 0.85% at a faculty meeting. The raises were then implemented by the Department Head, pending approval by the Dean of the College of Arts & Sciences and the Executive Vice President and Provost.

E. Support of Faculty Professional Development

Describe the adequacy of support for faculty professional development and 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 Policy Manual Section 7.20.70. “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, or Jefferson Laboratory in recent history).

The Department of Physics has a vibrant 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.

Most tenured physics faculty members (all except one) have significant external research grants (in excess of typically 100 k$ per year per faculty member). Their research grants typically contain funds for travel to conferences or other institutions. While primarily for research (and to update faculty knowledge in their area of specialty), conferences such as the general or March meetings of the American Physical Society usually also have sessions contributing to professional development in physics education, which are attended by our faculty members.

The Department of Physics (from its operational I&G funds) and the College of Arts & 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. 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.

To facilitate informal sharing of information between faculty members, physics faculty members meet once a week for a brown-bag lunch in the physics conference room. 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 and the Physics external advisory board also provide valuable information, advice, and recommendations to the physics faculty, both in their reports and also in meetings with individual faculty or with groups of faculty.

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

Letter of Compliance

Engineering Physics

Bachelor of Science in Engineering Physics

Self-Study Report

New Mexico State University

June 2012

Signature Attesting to Compliance

Signature Attesting to Compliance

By signing below, I attest to the following:

That the **<u>Engineering Physics Program</u>** has conducted an honest assessment of compliance and has provided a complete and accurate disclosure of timely information regarding compliance with ABET's *Criteria for Accrediting Engineering Programs* to include the General Criteria and any applicable Program Criteria, and the ABET *Accreditation Policy and Procedure Manual.*

<u>Sonya L. Cooper, Associate Dean</u>
Dean's Name (As indicated on the RFE)

Sonya L. Cooper

6/15/12

Signature **Date**

Appendix A: Syllabi

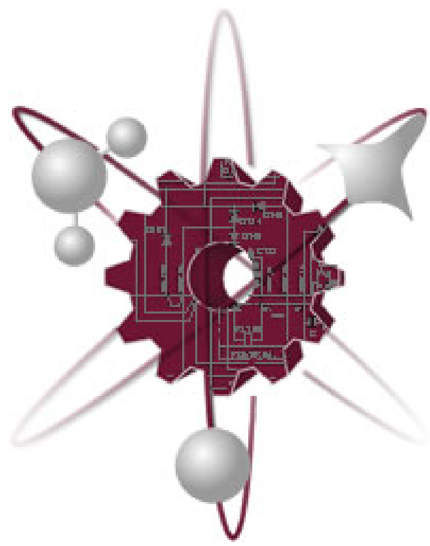
Engineering Physics

Bachelor of Science in Engineering Physics

Self-Study Report

New Mexico State University

Physics Courses



Course Number and Name: Physics 213, Mechanics

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 or Course Coordinator Name: Michaela Burkardt

Textbook: D. Young & R. A. Freedman, *University Physics with Modern Physics*, Pearson/Addison Wesley, 12th Edition, 2008

a) other supplemental materials: Mastering Physics for Young and Freedman, 12th edition.

Specific Course Information:

a) catalog description: Newtonian Mechanics

b) prerequisites or co-requisites: MATH 191G

c) This course is required for majors in Physics and Engineering Physics as well as Chemistry; (alternative: PHYS215G, *Engineering Physics I*)

Specific Goals of the Course:

a) specific outcomes of instruction: This course sets the foundation for undergraduate physics and engineering curriculum. 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) *apply knowledge of math, science and engineering.*

Brief List of Topics Covered:

The course covers material from Chapters 1-13, 15 of Young and Freedman's textbook. Number of lectures spend on each section are indicated.

Chapter 1: Units, Physical Quantities, and Vectors, Sec. 1-10: *(2 lectures)*
Chapter 2: Motion Along a Straight Line, Sec. 1-5: *(3 lectures)*
Chapter 3: Motion in Two or Three Dimensions, Sec. 1-5: *(3.5 lectures)*
Chapter 4: Newton's Laws of Motion, Sec. 1-6: *(2 lectures)*
Chapter 5: Applying Newton's Laws, Sec. 1-4: *(4.5 lectures)*
Chapter 6: Work and Kinetic Energy, Sec. 1-4: *(1 lecture)*
Chapter 7: Potential Energy and Energy Conservation, Sec. 1-5: *(4 lectures)*
Chapter 8: Momentum, Impulse, and Collisions, Sec. 1-6: *(5 lectures)*
Chapter 9: Rotation of Rigid Bodies, Sec. 1-6: *(2 lectures)*
Chapter 10: Dynamics of Rotational Motion, Sec. 1-7: *(3 lectures)*
Chapter 11: Equilibrium and Elasticity, Sec. 1-3, 5 *(1 lectures)*
Chapter 12: Gravitation, Sec. 1-5: *(2 lectures)*
Chapter 13: Periodic Motion, Sec. 1-8: *(3 lectures)*
Chapter 15: Mechanical Waves, Sec. 2-3, 6-8: *(2 lectures)*

Prepared by Michaela Burkardt, Spring 2012.

Course Number and Name: Physics 213L, Experimental Mechanics

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

Instructor or Course Coordinator Name: Chris Pennise

Textbook: The lab materials were developed by Dr. Steve Kanim of the NMSU Department of Physics. 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 213.
- **b) prerequisites or co-requisites:** PHYS 213 *(co-requisite)*.
- **c)** This course is the companion laboratory to Physics 213, Mechanics. It is required by all physics and engineering physics majors. Engineering Physics major can satisfy the requirement by taking PHYS 215L 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. ***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 Heinz Nakotte, Spring 2012.

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 (50-minute workshop) available.

Instructor or Course Coordinator Name: Michaela Burkardt

Textbook: D. Young & R. A. Freedman, *University Physics with Modern Physics*, Pearson/Addison Wesley, 12th Edition, 2008

a) other supplemental materials: MasteringPhysics for Young and Freedman, 12th edition.

Specific Course Information:

a) **catalog description:** : Electricity and Magnetism.

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 Program Outcome a) *apply knowledge of math, science and engineering.*

Brief List of Topics Covered:

The course covers material from Chapters 1-13 of Young and Freedman's textbook. Number of lectures spend on each section are indicated.

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

Prepared by Michaela Burkardt, Spring 2012.

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

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

Instructor or Course Coordinator Name: Chris Pennise

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 214.

b) **prerequisites or co-requisites:** Pa C or better in PHYS 213L or PHYS 215GL. *(pre-requisites)* and PHYS 214G *(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 216L 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. ***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. ***Lenz's law***
10. ***Faraday's law***
11. ***Plane and curved mirrors***
12. ***Ray diagrams and convex lenses***

Prepared by Heinz Nakotte, Spring 2012.

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: Stefan Zollner

Textbook: H.D. Young and R.A. Freedman, *University Physics*, 13th edition, Pearson, 2012

a) other supplemental materials: *Mastering Physics* for Young and Freedman, 13th edition.

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-req)*. The PHYS 215 course is calculus based and students should be able to take basic derivatives.

c) This course is required for most engineering disciplines, except Engineering Technology and Survey Engineering. It can also be used as a substitute for majors in Physics, Chemistry, and Engineering Physics with concentrations in *Aerospace*, *Chemical*, *Electrical*, and *Mechanical*.

Specific Goals of the Course:

a) specific outcomes of instruction: This course provides a calculus-based introduction to mechanics, especially Newton's laws, the linear motion of particles, and the rotational motion of rigid bodies. PHYS 215G and PHYS 216G (Engineering Physics II) prepare students for upper-division courses in engineering and physical sciences. Students learn how to apply their knowledge of mathematics (including algebra, trigonometry, geometry, and calculus) to problems in mechanics.

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.

Chapter 1, Sec. 1-10: Units, physical quantities and lectures (2 lectures)
Chapter 2, Sec. 2-5: Motion along a straight line (2 lectures)
Chapter 3, Sec. 1-4: Motion in two or three dimension (3 lectures)
Chapter 4, Sec. 1-6: Newton's laws of motion (2 lectures)
Chapter 5, Sec. 1-5: Applying Newton's laws (2 lectures)
Chapter 6, Sec. 1-4: Work and kinetic energy (2 lectures)
Chapter 7, Sec. 1-5: Potential energy and energy conservation (2 lectures)
Chapter 8, Sec. 1-5: Momentum, impulse, and collisions (3 lectures)
Chapter 9, Sec. 1-5: Rotation of rigid bodies (2 lectures)
Chapter 10, Sec. 1-6: Dynamics of rotational motion (2 lectures)

Chapter 11, Sec. 1-3: Equilibrium and statics (1 lecture)
Chapter 13, Sec. 1-5: Gravitation (1 lecture)
Chapter 14, Sec. 1-5: Periodic motion (1 lecture)
Chapter 15, Sec. 1-4: Mechanical waves (1 lecture)

Prepared by Stefan Zollner, Spring 2012.

Course Number and Name: Physics 215L, Engineering Physics I Laboratory

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

Instructor or Course Coordinator Name: Chris Pennise

Textbook: The lab materials were developed by Dr. Steve Kanim of the NMSU Department of Physics. 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*(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 Thomas Hearn, Spring 2012.

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

Credits and Contact Hours: 3 credits (three 50-minute lectures each week); an additional contact hour each week (during office hours). Tutoring assistance also available.

Instructor or Course Coordinator Name: Thomas Hearn

Textbook: H.D. Young and R.A. Freedman, *University Physics*, 13th edition, Pearson, 2012

a) other supplemental materials: *Mastering Physics* online homework for Young and Freedman, 13th edition.

Specific Course Information:

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

b) **prerequisites or co-requisites:** MATH 192G *(pre-requisite)*. The PHYS 216 course is calculus based and students should be able to take basic derivatives and integrals.

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. Together, PHYS 215G and PHYS 216G prepare students for upper-division courses in engineering and physical sciences.

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. There are about 32 total lectures.

Chapter 21: Introduction and electric charge (3 lectures)
Chapter 22: Gauss's law (2 lectures)
Chapter 23: Electric potential (2 lectures)
Chapter 24: Capacitance (3 lectures)
Chapter 25: Current, resistance, and voltage (3 lectures)
Chapter 26: DC circuits (2 lectures)
Chapter 27: Magnetic fields and forces (2 lectures)
Chapter 28: Magnetic sources (3 lectures)
Chapter 29: Induction (3 lectures)
Chapter 33: Nature of light (3 lectures)
Chapter 34: Geometric optics (4 lectures)
Chapter 35: Diffraction (2 lectures)

Prepared by Thomas Hearn, Spring 2012.

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

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

Instructor or Course Coordinator Name: Chris Pennise

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. Prerequisite: a C or better in PHYS 213L or PHYS 215GL. Corequisite: PHYS 216G. Students wishing to use the PHYS 215G-216 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 213L or 215L *(prerequisites)* and PHYS 216G *(corequisite)*.

c) This course is the companion laboratory to Physics 216, Engineering Physics II. 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 216.

b) **related ABET Outcomes:** PHYS 216L 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. ***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. ***Lenz's law***
10. ***Faraday's law***
11. ***Plane and curved mirrors***
12. ***Ray diagrams and convex lenses***

Prepared by Thomas Hearn, Spring 2012.

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)

Instructor or Course Coordinator Name: Stephen Pate

Textbook: Young and Freedman, *University Physics with Modern Physics*, 13th ed., Pearson Addison-Wesley.

a) other supplemental materials: numerous handouts distributed via web page

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 215 *(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, wave propagation, and the description of these phenomena and how these concepts can be generalized to give insight into optical processes. 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 Outcome:

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

Brief List of Topics Covered:

The course covers material from Chapters 13, 15-20, 33-36 of the Young and Freedman textbook. The number of lectures spent on each section are indicated.

Chapter 13: Periodic Motion (3)
Chapter 15: Mechanical Waves (4)
Chapter 16: Sound and Hearing (4)
Chapter 33: Nature and Propagation of Light (2)
Chapter 34: Geometric Optics (3)
Chapter 35: Interference (3)
Chapter 36: Diffraction (3)
Chapter 17: Temperature and Heat (4)
Chapter 18: Thermal Properties of Matter (4)
Chapter 19: First Law of Thermodynamics (4)
Chapter 20: Second Law of Thermodynamics (3)

Prepared by Stephen Pate, Spring 2012.

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: Stephen Pate

Textbook: Lab manual that was developed in the Department of Physics for this course.

a) other supplemental materials: numerous handouts distributed via web page

Specific Course Information:

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

b) prerequisites or co-requisites: PHYS 217 *(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 Outcome:

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

Brief List of Topics Covered:

The students perform 13 experiments during the semester, and each student writes an individual lab report for each experiment.

1. Error **analysis**
2. **Modes of a string**
3. **Resonance tube**
4. **Diffraction**
5. **Reflection/mirrors**
6. **Refraction/lenses**
7. **Bragg refraction**
8. **Thermal expansion**
9. **Thermal conduction**
10. **Thermal radiation**
11. **Calorimetry**
12. **Mechanical equivalent of heat**
13. **Ideal gas laws**

Prepared by Stephen Pate, Spring 2012.

Course Number and Name: Physics 305V, The Search For Water In The Solar System

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

Instructor or Course Coordinator Name: Boris Kiefer

Textbook: Harry Y. McSween, Jr. Stardust To Planets – A Geological Tour of the Universe

a) other supplemental materials: none

Specific Course Information:

a) **catalog description:** Examines the formation, abundance and ubiquity of water in our Solar System

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:

a) **specific outcomes of instruction:** This course provides the fundamental knowledge interdisciplinary reasoning. 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) 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 1-15Harry Y. McSween book.

Chapter 1: The Yellow Pages – Organization of the Solar System
Chapter 3: Could You Eat a Comet – A Close Encounter with the Nucleus of Comet Halley
Chapter 7: A Piece of the Red Planet – Meteorites From Mars?
Chapter 8: Hardened Hearts – Cores and Mantles of the Terrestrial Planets
Chapter 9: No Stone Left Unturned – Regolith on the Moon, Asteroids, and Planets
Chapter 10: And Not a Drop to Drink – Water on Mars
Chapter 14: Twinkle, Twinkle, Little Lump – Abundance of Elements in the Solar System
Chapter 15: Living in the Fast Lane – A Planetary Foothold for the Spark of Life

Prepared by Boris Kiefer, Spring 2012.

Course Number and Name: Physics 315, Modern 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: Young and Freedman, *University Physics with Modern Physics*, 12th ed., Pearson Addison-Wesley; or equivalent modern physics textbook in consultation with the instructor.

a) other supplemental materials: numerous handouts distributed via web page

Specific Course Information:

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

b) prerequisites or co-requisites: PHYS 214 or 216, MATH 291 *(all pre-reqs)*

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 principles and basic equations of the special theory of relativity and quantum mechanics and their applications in simple problems in various fields of physics. This knowledge will be applied in more advanced and specialized topics to be studied in later years.

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

a) Apply knowledge of math, science, and engineering.
f) Have an understanding of professional and ethical responsibility.
h) Understand the impact of engineering solutions in a global, economic, environmental, and societal context.
i) Recognize the need for, and have the ability to engage in, lifelong learning.
j) Have a knowledge of contemporary issues

Brief List of Topics Covered:

The course covers material from Chapters 37-44 of the Young and Freedman textbook. The number of lectures spent on each section are indicated.

Chapter 37: Relativity (3)
Chapter 38: Photons, Electrons and Atoms (4)
Chapter 39: The Wave Nature of Particles (4)
Chapter 40: Quantum Mechanics (4)
Chapter 41: Atomic Structure (4)
Chapter 42: Molecules and Condensed Matter (4)
Chapter 43: Nuclear Physics (4)
Chapter 44: Particle Physics and Cosmology (1)

Prepared by Stephen Pate, Spring 2012.

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: numerous handouts distributed via web page

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. **Charge of the Electron – Millikan Oil Drop Experiment**
6. **Quantization of Atomic Energy Levels – Franck-Hertz Experiment**
7. **Nuclear Magnetic Resonance**
8. **Electrical Conductivity of Metals and Semi-conductors**
9. **Nuclear Spectroscopy**

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

10. **The Hall Effect**
11. **The Speed of Light**
12. **The Zeeman effect**
13. **Infrared Absorption Spectroscopy – Barnes Spectrometer**
14. **Advanced Atomic Spectroscopy – Jarrell-Ash Spectrometer**
15. **Rutherford Scattering and the Range of Alpha Particles in Matter**

Prepared by Stephen Pate, Spring 2012.

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: Matthias Burkardt

Textbook: M.L. Boas, *Mathematical Methods in the Physical Sciences*, 3rd edition, Wiley, ISBN: 978-0-471-19826-0

a) other supplemental materials: practice problems

Specific Course Information:

a) **catalog description:** Introduction to the mathematics used in intermediate level physics courses

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

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

Specific Goals of the Course:

a) **specific outcomes of instruction:** This course provides basic competence in multiple areas of mathematics needed in upper division courses in physics, chemistry, and engineering. This course trains students in selected mathematical methods applied to science and engineering problems.

b) **related ABET Outcomes:** PHYS 395 addresses Program Outcome e) *develop an ability to identify, formulate, and solve engineering problems*.

Brief List of Topics Covered:

The course covers material from Chapters 2-8 of Boas' textbook. Number of lectures spend on each chapter are indicated.

Chapter 2: Complex Numbers (4 lectures):
Real and imaginary part of a complex number; the complex plane; complex algebra, Euler's formula; powers and roots of a complex numbers; logarithms

Chapter 3: Linear Algebra (8 lectures):
Vectors; matrices; matrix operations; row reduction; determinants; Cramer's rule; special matrices; eigenvalues; eigenvectors; matrix diagonalization; applications of diagonalization.

Chapter 4: Partial Differentiation (3 lectures):
Notation; total differential; chain rule; change of variables; waves

Chapter 5: Multiple Integrals (3 lectures):
Double and triple integrals; change of variables; Jacobian; surface integrals

Chapter 6: Vector Analysis 5 lectures):

Application of vector multiplication; triple products; differentiation of vectors; fields; gradient; line integrals; divergence; Gauss ' theorem; curl; Stokes' theorem; Helmholtz theorem

Chapter 7: Fourier Series and Transforms (2 lectures)
Simple harmonic motion; wave motion; application of Fourier Series; Fourier integrals

Chapter 8: Ordinary Differential Equations (3 lectures)
Separable equations; Linear first order equations; other methods for first order equations; second order equations with constant coefficients; other second order equations; the Dirac delta function.

Prepared by Matthias Burkardt, Spring 2012.

Course Number and Name: Physics 450, Selected Topics: Capstone Design

Credits and Contact Hours: 3 credits (150 minutes combined meeting and lab time)

Instructor or Course Coordinator Name: Stephen Kanim

Textbook: None

- **a) other supplemental materials:** Research paper reading as required

Specific Course Information:

- **a)** **catalog description:** Readings, lectures or laboratory studies in selected areas of physics. May be repeated for a maximum of 12 credits.
- **b)** **prerequisites or co-requisites:** None.
- **c)** This is an elective course. May be used as part of the Engineering Physics capstone design experience.

Specific Goals of the Course:

- **a)** **specific outcomes of instruction:** This course provides real-world experience in research, design, testing, development, and prototype manufacture.
- **b)** **related ABET Outcomes:** PHYS 450 addresses Program Outcomes, to develop *c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability; d) an ability to function in multidisciplinary teams; g) an ability to communicate effectively; and k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice*.

Brief List of Topics Covered:

Depends on specific design task or project.

Prepared by Stephen Kanim, Spring 2012.

Course Number and Name: Physics 451, Intermediate Mechanics I

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

Instructor or Course Coordinator Name: Thomas Hearn

Textbook: Analytical Mechanics, Seventh edition, by Fowles & Cassiday, Thompson/Brooks/Cole Publishing, 2005.

a) other supplemental materials: Occasional handouts by instructor.

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, non-inertial reference frames, oscillating systems, relativistic mechanics, classical scattering, and fluid mechanics.

b) **prerequisites or co-requisites:** PHYS 213 or PHYS 215G, and MATH 291G. Co-requisite: MATH 392.

c) This course is required for majors in Physics and Engineering Physics with concentrations in Electrical Engineering and Chemical Engineering. It is an elective for majors in Engineering Physics with concentrations in Mechanical or Aerospace Engineering.

Specific Goals of the Course:

a) **specific outcomes of instruction:** This course builds on their introductory mechanics course (PHYS 213 or PHYS 215) and is an integral part of the upper-division physics core, which includes PHYS 451, 454&455 and 461&462. The course views Newtonian mechanics from a differential equations viewpoint and provides an introduction to Lagrangian and Hamiltonian formulations of mechanics. Students should be able to solve Newton's equation from the viewpoint of a differential equation, understand polar, cylindrical, and spherical coordinate systems including their rotation, use Newton's Law of gravity, understand particle scattering and systems of particles, and apply Lagrange's equations to mechanical systems.

b) **related ABET Outcomes:** PHYS 451 addresses Program Outcomes e) *develop an ability to identify, formulate, and solve engineering problems*.

Brief List of Topics Covered:

The course covers material from Chapters 1-7, and 10 of the Fowles and Cassiday text. Approximate number of 50 minute lectures spend on each section are indicated. (38 lectures plus 4 test days).

Chapter 1: Fundamental Concepts: Vectors

Vectors, scalar and vector products, coordinate systems, changes in coordinate systems, vector derivatives, velocity and acceleration in different coordinate systems. (3 lectures).

Chapter 2: Newtonian Mechanics: Rectilinear Motion of a Particle

Newton's laws of motion, uniform acceleration under a constant force, forces that depend on position, kinetic and potential energy, forces that depend on velocity, fluid resistance, terminal velocity. (4 lectures).

Chapter 3: Oscillations

Linear restoring forces and simple harmonic motion, energy in harmonic motion, damped harmonic motion, forced harmonic motion. (4 lectures).

Chapter 4: General Motion of a Particle in Three Dimensions

Potential energy in three-dimensional motion, the del operator, forces of the separable type, projectile motion, harmonic oscillators in two and three dimensions, motion of charged particles in electric and magnetic fields, constrained motion of a particle. (5 lectures).

Chapter 5: Noninertial Reference Systems

Accelerated coordinate systems, rotating coordinate systems, effects of Earth rotation, the Foucault pendulum. (5 lectures).

Chapter 6: Gravitation and Central Forces

The gravitational force, Kepler's three laws of planetary motion, potential energy in gravitational and central force fields, the energy equation of an orbit in central and inverse-square fields, effective potential and orbital stability, apsides and apsidal angles, motion in inverse-square repulsive fields and scattering. (10 lectures).

Chapter 7: Dynamics of Systems of Particles

Center of mass and linear momentum, angular momentum and kinetic energy of systems, two-body problems and reduced mass, collisions and scattering, variable mass and rocket motion. (3 lectures).

Chapter 10: Lagrangian Mechanics

Hamilton's variational principle, generalized coordinates, kinetic and potential energy in generalized coordinates, Lagrange's equations of motion for conservative systems, generalized momenta, constraints and Lagrange multipliers, D'Lambert's principle and generalized forces, Hamilton's equations. (4 lectures).

Prepared by Thomas Hearn, Spring 2012.

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

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

Instructor or Course Coordinator Name: Boris Kiefer

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:** 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 392 *(co-req.)*, and MATH 392 *(co-req.)*

c) This course is required for majors in Physics and Engineering Physics with concentrations in Aerospace, Chemical, Electrical, and Mechanical Engineering.

Specific Goals of the Course:

a) **specific outcomes of instruction:** This course provides the fundamental knowledge of quantum mechanics 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 considering Schrödinger's equations including intrinsic spin, matrix representation of wave functions and observables, time evolution, and motion in one dimension.

b) **related ABET Outcomes:** PHYS 455 addresses Program Outcome e) *develop an ability to identify, formulate, and solve engineering problems*.

Brief List of Topics Covered:

The course covers material from Chapters 1-7 of the J. S. Townsend textbook.

Chapter 1: Stern-Gerlach Experiments

1.1. Original Stern-Gerlach Experiment
1.2. Four Experiments
1.3. The Quantum State Vector
1.4. Analysis of Experiment 3
1.5. Experiment 5

Chapter 2: Rotation of Basis States and Matrix Mechanics

2.1. The Beginnings of Matrix Mechanics
2.2. Rotation Operators
2.3. The Identity and Projection Operators
2.4. Matrix Representation of Operators
2.5. Changing Representations
2.6. Expectation Values
2.7. Photon Polarization and the Spin of the Photon

Prepared by Boris Kiefer, Fall 2011.

Course Number and Name: Physics 455, Intermediate Modern Physics II

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

Instructor or Course Coordinator Name: Boris Kiefer

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 topics in PHYS454

b) **prerequisites or co-requisites:** PHYS 454 *(pre-req)*

c) This course is required for majors in Physics and Engineering Physics with concentrations in Aerospace, Chemical, Electrical, and Mechanical Engineering.

Specific Goals of the Course:

a) **specific outcomes of instruction:** This course provides the fundamental knowledge of quantum mechanics 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 considering Schrödinger's equations including 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) **related ABET Outcomes:** PHYS 455 addresses Program Outcome e) *develop an ability to identify, formulate, and solve engineering problems*.

Brief List of Topics Covered:
The course covers material from Chapters 9-14 of the J. S. Townsend textbook.

Chapter 9: Translational and Rotational Symmetry in the Two-Body Problem

9.1. Elements of Wave Mechanics in Three Dimensions
9.2. Translational Invariance
9.3. Center-of-Mass Coordinated
9.4. Ground-State Energies And Uncertainty Principle
9.5. Rotational Invariance
9.6. Complete set of Commuting Variables
9.7. Vibrations and Rotations of Diatomic Molecules
9.8. Position-Space Representation of Angular Momentum
9.9. Orbital Angular Momentum Eigenfunctions

Chapter 10: Bound States of Central Potentials

10.1. Asymptotic Behavior of Wave Functions
10.2. Hydrogen Atom
10.3. The Finite Spherical Well and the Deuteron

10.4. The Infinite Spherical Well
10.5. The 3-d Isotropic Harmonic Oscillator

Chapter 11: Time-Independent Perturbations
11.1. Nondegenerate Perturbation Theory
11.2. Example, Involving 1-d Harmonic Oscillator
11.3. Degenerate Perturbation Theory
11.4. Start Effect in Hydrogen
11.6. Relativistic Perturbations of the Hydrogen Atoms
11.8. Zeeman Effect in Hydrogen
Chapter 12: Identical Particles
12.1. Indistinguishable Particles in Quantum Mechanics
12.2. Helium Atom
12.3. Multielectron Atoms and the Periodic Table
12.4. Covalent Bonding
Chapter 13: Scattering
13.1. Asymptotic Wave Function and the Differential Cross Section
13.2. Born Approximation
13.3. Example of the Born Approximation: Yukawa Potential
13.4. The Partial Wave Expansion
13.5. Examples of Phase-Shift Analysis
Chapter 14: Photons and Atoms
14.1. Aharonov-Bohm Effect
14.2. Hamiltonian for the Electromagnetic Field
14.3. Quantizing the Radiation Field
14.4. Properties of Photons
14.5. Hamiltonian of the Atom and the Electromagnetic Field
14.6. Time-Dependent Perturbation Theory
14.7. Fermi's Golden Rule
14.8. Spontaneous Emission

Prepared by Boris Kiefer, Spring 2012.

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

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: Heinrich Nakotte

Textbook: D.J. Griffiths, *Introduction to Electrodynamics*, 3rd edition, Prentice Hall, 1999

  a) other supplemental materials: none

Specific Course Information:

a) **catalog description:** covers electro- and magneto-statics, dielectric and magnetic materials, DA and AC circuits, electromagnetic wave propagation, reflection, refraction, wave guides, radiating systems, interference and diffraction, Newtonian and relativistic electrodynamics, magnetohydrodynamics and plasma physics*

   ****catalog description is no longer up-to-date and will be changed in the next Undergraduate Catalog***

b) **prerequisites or co-requisites:** PHYS 214 or 216G, MATH 291*(pre-reqs.)*

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

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 Outcome e) *develop an ability to identify, formulate, and solve engineering problems*.

Brief List of Topics Covered:
The course covers material from Chapters 1-6 of Griffiths textbook. Number of lectures spend on each section are indicated.

Chapter 1: Vector Analysis
1.1. Vector Algebra *(1/3 lecture)*
1.2. Differential Calculus *(1/3)*
1.3. Integral Calculus *(1/3)*
1.4. Curvilinear Coordinates *(1/3)*
1.5. The Dirac Delta Function *(1/3)*
1.6. The Theory of Vector Fields *(1/3)*
Chapter 2: Electrostatics
2.1. The Electric Field *(1)*
2.2. Divergence and Curl of Electrostatic Field *(1)*

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

Prepared by Heinz Nakotte, Fall 2011.

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: Heinrich Nakotte

Textbook: D.J. Griffiths, *Introduction to Electrodynamics*, 3rd edition, Prentice Hall, 1999

a) other supplemental materials: none

Specific Course Information:

a) **catalog description:** continuation of topics in PHYS461

b) **prerequisites or co-requisites:** PHYS 461*(pre-req)*

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

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 considering Maxwell's equations in vacuum and matter, magnetic induction, electromagnetic wave propagation (including reflection, refraction, absorption, dispersion), waveguides, dipole radiation and relativistic electrodynamics.

b) **related ABET Outcomes:** PHYS 462 addresses Program Outcome e) *develop an ability to identify, formulate, and solve engineering problems*.

Brief List of Topics Covered:
The course covers material from Chapters 7-12 of Griffiths textbook. Number of lectures spend on each section are indicated.

Chapter 7: Electrodynamics
7.1. Electromotive Force *(1 lecture)*
7.2. Electromagnetic Induction *(2)*
7.3. Maxwell's Equations *(2)*
Chapter 8: Conservation Laws
8.1. Charge and Energy *(1)*
8.2. Momentum *(1)*
Chapter 9: Electromagnetic Waves
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: Potential and Fields

10.1. The Potential Formulation *(1)*
10.2. Continuous Distributions *(1)*
10.3. Point Charges *(1)*
Chapter 11: Radiation
11.1. Dipole Radiation *(1.5)*
11.2. Point Charges *(1.5)*
Chapter 12: Electrodynamics and Relativity
12.1. The Special Theory of Relativity *(1)*
12.2. Relativistic Mechanics *(1)*
12.3. Relativistic Electrodynamics *(2)*

Prepared by Heinz Nakotte, Spring 2012.

Course Number and Name: Physics 473, Introduction to Optics

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: Michael DeAntonio

Textbook: Hecht, *Optics*, 4th edition, Addison Wesley, 2001

a) other supplemental materials: none

Specific Course Information:

a) **catalog description:** The nature of light, geometrical optics, basic optical instruments, wave optics, aberrations, polarization, and diffraction. Elements of optical radiometry, lasers and fiber optics.

b) **prerequisites or co-requisites:** PHYS 216 or 217. Cross-listed as PHYS 473.

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

Specific Goals of the Course:

a) **specific outcomes of instruction:** Describe general waves and wave motion. Use the basic laws of electromagnetism to determine the wave equations for electromagnetic radiation. Calculate the energy, momentum and Poynting vector for particular electromagnetic waves. Describe the dipole source of waves including basic radiation theory and polarization. Describe the effect of waves on a dielectric by the use of simple forcing functions. Describe in detail the process of Rayleigh scattering. Calculate the angles and intensity of light after single or multiple reflection or refraction. Describe the basic process of Huygens' wavelets and Fermat's principle. Predict the final color of light when two colors are mixed in emitting sources, after reflection and after transmitting through color filters. Calculate the RGB values for primary and secondary colors on a computer. Calculate the value of the critical angle and the intensity of light under total internal reflection. Calculate the effect of multiple mirrors and lenses in a system. Determine the effects of an aperture in a complex optical system. Find the entrance and exit pupil in a complex optical system. Perform ray traces for complex optical systems graphically. Calculate the deviation of light through a prism.

b) **related ABET Outcomes:** PHYS 473 addresses Program Outcome e) *an ability to identify, formulate, and solve engineering problems*, i) *a recognition of the need for and an ability to engage in life-long learning*, j*) a knowledge of contemporary issues*, k) *an ability to use the techniques, skills, and modern engineering tools necessary for engineering physics practice*.

Brief List of Topics Covered:
The course covers material from Chapters 2-9 of Hecht's textbook. Number of lectures spent on each chapter are indicated.

Chapter 2: Wave Motion (5 lectures)
2.1. One-Dimensional Waves
2.2. Harmonic Waves

2.3. Phase and Phase Velocity
2.4. The Superposition Principle
2.5. The Complex Representation
2.6. Phasors and the Addition of Waves
2.7. Plane Waves
2.8. Three-Dimensional Differential Wave Equation
2.9. Spherical Waves
2.10. Cylindrical Waves

Chapter 3: Electromagnetic Theory, Photons and Light (4 lectures)

3.2. Electromagnetic Waves
3.3. Energy and Momentum
3.4. Radiation
3.5. Light in Bulk Matter
3.6. The electromagnetic-Photon Spectrum

Chapter 4: The Propagation of Light (7 lectures)

4.3. Reflection
4.4. Refraction
4.6. The Electromagnetic Approach
4.7. Total Internal Reflection
4.9. Familiar Aspects of the Interaction of Light with Matter
4.10. The Stokes Treatment of Reflection and Refraction

Chapter 5: Geometrical Optics (6 lectures)

5.2. Lenses
5.3. Stops
5.4. Mirrors
5.5. Prisms

Chapter 6: More on Geometrical Optics (5 lectures)

6.1. Thick Lenses and Lens Systems
6.2. Analytical Ray Tracing
6.3. Aberrations

Chapter 7: The Superposition of Waves (2 lectures)

7.1. The Addition of Waves of the Same Frequency
7.2. The Addition of Waves of Different Frequency

Chapter 8: Polarization (4 lectures)

8.1. The Nature of Polarized Light
8.2. Polarizers
8.6. Polarization by Reflection

Chapter 9: Interference (4 lectures)

9.1. General Considerations
9.2. Conditions for Interference
9.3. Wavefront-splitting

Prepared by Michael DeAntonio, Spring 2012.

Course Number and Name: Physics 475, Advanced Physics Laboratory

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: Vassilios Papavassiliou

Textbook: None

> **a) other supplemental materials:** Instructor's handouts, equipment manuals, web resources

Specific Course Information:

a) **catalog description:** Advanced undergraduate laboratory, involving experiments in atomic, molecular, nuclear, and condensed-matter physics.

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

c) This course is required for majors in Physics (for the Bachelor of Science degree) and Engineering Physics

Specific Goals of the Course:

a) **specific outcomes of instruction:** This course is a fundamental part of the upper-division physics course sequence. Students perform complex experiments, performed extensive error analysis, and present their results in written and oral reports. The course provides up to three credits of engineering physics.

b) **related ABET Outcomes:** PHYS 475 addresses Program Outcomes *b) an ability to design and conduct experiments, as well as to analyze and interpret data; d) an ability to function in interdisciplinary teams; f) an understanding of professional and ethical responsibility; g) an ability to communicate effectively;* and *k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.*

Brief List of Topics Covered:

The lab includes lectures in probability, statistics, and error propagation as well as radiation safety, and lab sessions performing experiments in nuclear, particle, and condensed-matter and materials physics. The number of sessions devoted to each topic is listed. Each group performed two out of three experiments 4-6 and two out of three experiments among 7-9.

1. **Lectures in statistical and error analysis (2 sessions)**
2. **Radiation safety lecture (1 session)**
3. **Practical exercise in statistics with Geiger counters (2 sessions)**
4. **Muon decay (4 sessions)**
5. **Gamma-gamma angular correlation (4 sessions)**
6. **Compton scattering (4 sessions)**
7. **Infrared spectroscopy (4 sessions)**
8. **Small-angle X-ray scattering (4 sessions)**
9. **X-ray fluorescence**

Prepared by Vassilios Papavassiliou, Spring 2012.

Course Number and Name: Physics 476, Computational Physics

Credits and Contact Hours: 3 credits, an additional 2 office hours

Instructor or Course Coordinator Name: William Gibbs

Textbook: W. R. Gibbs, Computation in Modern Physics, World Scientific

Specific Course Information:

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

b) **prerequisites or co-requisites:** MATH 392 *(pre-req)*. senior standing

c) This course is required for majors in Physics (for the Bachelor of Science degree) and Engineering Physics with concentrations in Electrical Engineering. It is a possible elective for the other Engineering Physics concentrations

Specific Goals of the Course:

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

b) **related ABET Outcomes:** PHYS 476 addresses Program Outcomes a) apply knowledge of math, science and engineering, e) to identify, formulate and solve engineering and physics problems, and *k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.*

Brief List of Topics Covered:

Classical integration techniques (trapezoidal and Simpson's rules, Gauss-Legendre and Gauss-Laguerre integration, principal-value integrals), Monte Carlo techniques (sampling, evaluation of multi-dimensional integrals, radiation transport), Differential equations (classical motion, molecular dynamics), Computer architecture for Scientists, Systems of equations (linear algebra, elimination and eigenvalue techniques), Finite element methods in one and two dimensions, Signal processing, Chaotic systems (Feigenbaum's numbers).

Prepared by Dr. William R. Gibbs, Fall 2011.

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: numerous handouts distributed via web page

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:** PHYS 480 addresses Program Outcome e) *develop an ability to identify, formulate, and solve engineering problems*.

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.

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

Prepared by Stephen Pate, Spring 2012.

Course Number and Name: Physics 488, 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 or Course Coordinator Name: Heinz Nakotte

Textbook: Charles Kittel, *Introduction to Solid State Physics*, 8th edition, John Wiley & Sons, 2005.

a) other supplemental materials: hand-outs from various 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 majors in Physics and Engineering Physics with any of the concentrations. In general, it is cross-listed with PHYS588, a slightly more advanced course taken by physics graduate students. The class material covered in PHYS 488 and PHYS588 is the same for both undergraduate and graduate students; 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. Some classes of materials, such as semiconductors, superconductors, nanomaterials and permanent-magnet materials may be discussed as well.

b) related ABET Outcomes: PHYS 488 addresses Program Outcomes: f) *an understanding of professional and ethical responsibility*, h) *the broad education necessary to understand impact of engineering solutions in a global, economic, environmental, and societal context*, i) *a recognition of the need for and an ability to engage in lifelong learning*, and j) *a knowledge of contemporary issues*.

Brief List of Topics Covered:

The course covers material from the following chapters in Kittel's textbook. Some chapters are covered in more detail than others. The number of lectures spend on each chapter are indicated.

Chapter 1: Crystal Structure *(2 lectures)*
Chapter 2: Wave Diffraction and Reciprocal Lattice *(2)*
Chapter 3: Crystal Binding and Elastic Constants *(2)*
Chapter 4: Phonons I. Crystal Vibrations *(2)*
Chapter 5: Phonons II. Thermal Properties *(2)*
Chapter 6: Free Electron Fermi Gas *(2)*

Chapter 7: Energy Bands ***(2)***
Chapter 8: Semiconductor Crystals ***(1)***
Chapter 10: Superconductivity ***(1)***
Chapter 11: Diamagnetism and Paramagnetism ***(1)***
Chapter 12: Ferro- and Antiferromagnetism ***(1)***
Chapter 15: Optical Processes ***(1)***
Chapter 16: Dielectrics and Ferroelectrics ***(1)***
Chapter 18: Nanostructures ***(3)***
Chapter 19: Non-Crystalline Solids ***(2)***

Prepared by Heinz Nakotte, Fall 2011

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

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: Peter de Châtel

Textbook: no particular textbook required. *For some general guidance, however, Philip Ball published an excellent book called "Made to Measure - New Materials for the 21st Century" (Princeton University Press, 1999), which introduces a variety of advanced materials to the general audience*.

- **a) other supplemental materials:** hand-outs from various sources

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.

Specific Goals of the Course:

- a) specific outcomes of instruction: The main goal of this course is for students to identify and understand the microscopic mechanisms responsible for an improved performance of modern materials. The materials to be discussed will be those, which have enabled recent breakthroughs in the fastest growing industries: communication and information storage, energy and aerospace industry. To understand the mechanisms alluded to above, we shall have to touch some aspects of solid state physics (magnetism, mechanical, optical and electrical properties of materials, magneto-optics and –resistivity, semiconductors). Chapters of textbooks available in the library and handouts will be provided to help students to familiarize themselves with these subjects.
- **b) related ABET Outcomes:** PHYS 489 addresses Program Outcomes: f) *an understanding of professional and ethical responsibility*, h) *the broad education necessary to understand impact of engineering solutions in a global, economic, environmental, and societal context*, i) *a recognition of the need for and an ability to engage in lifelong learning*, and j) *a knowledge of contemporary issues*.

Brief List of Topics Covered:
Below is the list of topics covered over the course of the semester:
Weeks 1&2: Magnetism and Magnetic Materials
Week 3: Magneto-Optic Effects
Weeks 4&5: Magneto-electronic Materials and Devices
Weeks 6&7: Magnetic Multilayers and Spintronics
Weeks 8-10: Fiber Optics and Photonics
Weeks 11&12: Materials for Alternative Energy (solar, wind, batteries & fuel cells)
Weeks 13&14: Nanomaterials (in particular, carbon)

Prepared by Peter de Châtel, Spring 2012.

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

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: Dennery and Krzywicki, *Mathematics for Physicists*, Dover

a) other supplemental materials: numerous handouts distributed via web page

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 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 495 addresses Program Outcome *k) Use techniques, skills and modern tools necessary for engineering and physics practice.*

Brief List of Topics Covered:

The course covers material from Chapters 1-3 of the Dennery and Krzywicki textbook. The number of lectures spent on each section are indicated.

Chapter 1: The Theory of Analytic Functions (11)
Chapter 2: Linear Vector Spaces (18)
Chapter 3: Function Space, Orthogonal Polynomials, and Fourier Analysis (9)

Prepared by Stephen Pate, Spring 2011.

Aerospace Engineering Courses

Course Information	**AE 339 Aerodynamics** 3 credits Required Spring 2012
INSTRUCTOR:	Dr. Shashikanth Office: JH611 Phone: 646-4348 email: shashi@nmsu.edu
ASSISTANTS:	NA
OFFICE HOURS:	1:30—3:30pm MW
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:	ME 237
COREQUISITES	M E 328, C E 301
TEXT:	*Munson, Bruce R., Young, Donald F.,Okiishi, H. & Huebsch, W.W., Fundamentals of Fluid Mechanics, 6th ed., John Wiley, 2009.* Supplemental Text: *Anderson, John D., Fundamentals of Aerodynamics, 3rd ed., McGraw-Hill, 2006.*
CLASS SCHEDULE:	Lecture: 10:30 a.m. - 11:20 a.m. - MWF - JH 204
GRADES:	Homework: 15% Four exams: 45% (total) Class Participation: 5% Final: 35%
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 and momentum 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).

Course Information	**AE 339 Aerodynamics** 3 credits Required Spring 2012
TOPICS COVERED:	• Review of Vector Calculus, Part A • Fluid Statics • Flow Kinematics • Bernoulli's Equation • Laplace's equation and potential flows • Review of Vector Calculus, Part B • Control Volume analysis • Similitude, Dimensional Analysis and Modeling • Aerodynamic lift and drag coefficients
RELATIONSHIP TO PROGRAM EDUCATIONAL OBJECTIVES:	A mastery of the fundamentals of mechanical engineering D ability to formulate, analyze, and creatively participate in the solution of multidisciplinary problems through use of modern engineering
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)
RELATIONSHIP TO ABET SPECIFIC CRITERIA:	ME2 ability to apply advanced mathematics through multivariate calculus and differential equations ME3 familiarity with statistics and linear algebra
POLICIES:	• HWs are due back on the date specified. **No late HWs will be accepted** • HW solutions will be posted on bulletin board outside my office. • Credit (either a make-up or an average score based on all your other quizzes and exams) for any missed exam or quiz will be given only if: o You inform me before the start o the exam or quiz AND o You produce a written signed document giving a valid excuse for your absence. **Otherwise, you will get a zero for the exam missed.**
AUTHOR/DATE:	B. Shashikanth January 2012

Course Information	**AE 362 Orbital Mechanics** 3 credits Required Spring 2012
INSTRUCTOR:	Dr. D. Westpfahl Office: NMT Phone: 835-5792 email: dwestpfa@nmt.edu
ASSISTANTS:	NA
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 and ME 237
TEXT:	*Fundamentals of Astrodynamics by Roger R. Bate, Donald D. Mueller, and Jerry E. White (Dover 1971).*
CLASS SCHEDULE:	Lecture: 8:00 a.m. - 9:15 a.m. - MW – JH604
GRADES:	Grading: Grades will be based on performance on homework and class projects.
COURSE OBJECTIVES:	• Our goal is to master the course content well enough to go on to graduate study or work in the aerospace industry. This is a first course in orbital mechanics. It will allow you to calculate orbits from observations and to participate in the planning of orbital and suborbital missions. Students will become conversant in these subjects, but it is impossible to become an expert in a single course.
TOPICS COVERED:	• Newtonian mechanics and Newtonian gravitation • Constants of the motion and the trajectory equation • Energy • Angular momentum • Coordinate systems for the study of orbits • Basic orbital maneuvers • Space vehicle positions and velocities • Trajectories
RELATIONSHIP TO PROGRAM EDUCATIONAL OBJECTIVES:	A mastery of the fundamentals of aerospace engineering
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 362 Orbital Mechanics** 3 credits Required Spring 2012
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 are expected to attend class. Acceptable reasons for missing class include illness, travel to visit grad schools, personal or family emergencies, special research opportunities, and field trips for work in other classes. • We will use an Orbital Mechanics Concept Inventory at the beginning and end of the semester for assessment. • The class is paced to cover most of the text in one semester. This is a rate that accommodates most students. If you find this pace too slow please let me know; I am willing to provide the assignments and allow you to work at a more rapid pace. • Students are encouraged to work together. I will be available for help during office hours, after class meetings, and at other times by appointment. Informal drop-in visits to my office are strongly encouraged.
AUTHOR/DATE:	D. Westpfahl January 2012

Course Information	**AE 363 Aerospace Structures** 3 credits Required Spring 2012
INSTRUCTOR:	Dr. Young Lee Office: JH610 Phone: 646-7457 email: younglee@nmsu.edu
ASSISTANTS:	NA
OFFICE HOURS:	10:20 a.m.- 12:00 p.m. TR or by appointment
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:	*Analysis of Aircraft Structures – An Introduction, 2nd Edition, Bruce K. Donaldson, Cambridge Aerospace Series, 2008*
CLASS SCHEDULE:	Lecture: 9:30 a.m. - 10:20 a.m. - MWF - JH 209
GRADES:	Homework 10% Midterm exam 40% Final exam 35% Class project 15%
COURSE OBJECTIVES:	<u>After completing this course, a student should be able to:</u> • 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 2012
RELATIONSHIP TO PROGRAM EDUCATIONAL OBJECTIVES:	A mastery of the fundamentals of aerospace engineering
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:	• Lectures will be self-contained so textbooks might not need to be purchased; and all the relevant materials will be posted on Blackboard. • Team efforts are allowed and strongly recommended for homework and the class project. • Homework will be taken up at the beginning of class on the due date. Late homework will be accepted but with a penalty of 20% reduction within a day and 50% within a week. Those submitted longer than a week after the due date will not get any credit. • All exams will be closed-book with the relevant equations being provided. In principle, make-up exams will not be provided. • Final letter grades will be on a curve. • A team class project will require a final report. Details of project will be posted before the Midterm Exam 1. • Other remarks: o Any person caught plagiarizing or cheating in this course will get the letter grade F, regardless of their previous grade. For the University definition of plagiarism, see the Student Code of Conduct at http://www.nmsu.edu/~vpsa/SCOC/intro.html). o Students with disabilities: Feel free to contact Diana Quintana (Director, University Disability Services; diquinta@nmsu.edu or 575-646-2400) with any questions on student issues related to the Americans with Disabilities Act and/or Section 504 of the Rehabilitation Act of 1973. All medical information will be treated confidentially.
AUTHOR/DATE:	Y. Lee January 2012

Course Information	**AE 364 Flight Dynamics and Controls** 3 credits Required Spring 2012
INSTRUCTOR:	Dr. Young Lee Office: JH610 Phone: 646-7457 email: younglee@nmsu.edu
ASSISTANTS:	NA
OFFICE HOURS:	10:20 a.m.- 12:00 p.m. TR 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
TEXT:	*Flight Stability and Automatic Control, 2nd ed., Robert C. Nelson, McGraw-Hill, 1998*
CLASS SCHEDULE:	Lecture: 8:55 a.m. - 10:10 a.m. - TR - JH 205
GRADES:	Homework 10% Midterm exam 40% Final exam 35% Class project 15%
COURSE OBJECTIVES:	<u>After completing this course, a student should be able to:</u> • 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; • Implement some control theories for autopilot design; • Learn various tools to carry out projects that require computer simulations.
TOPICS COVERED:	• Preliminaries: Laplace transformation, block diagram, transfer function, etc.; • Static stability and control: Longitudinal/directional/lateral stabilities; • Aircraft equations of motion: 6-DOF model, Euler angles, stability derivatives; • Longitudinal motions: Phugoid/short-period modes; • Lateral/directional motions: Spiral/rolling/Dutch-roll modes; • Automatic control theory for aircraft autopilot designs.
RELATIONSHIP TO PROGRAM EDUCATIONAL OBJECTIVES:	A mastery of the fundamentals of aerospace engineering B ability to formulate, analyze, and creatively participate in the solution of multidisciplinary problems through use of modern engineering

Course Information	**AE 364 Flight Dynamics and Controls** 3 credits Required Spring 2012
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:	• Lectures will be self-contained so textbooks might not need to be purchased; and all the relevant materials will be posted on Blackboard. • Use of Matlab will be strongly encouraged for performing numerical simulations and verifying your analysis. • Team efforts are allowed and strongly recommended for doing homework and the class project. • Homework will be taken up at the beginning of class on the due date. Late homework will be accepted but with a penalty of 20% reduction within a day and 50% within a week. Those submitted longer than a week after the due date will not get any credit. • All exams will be closed-book with the relevant equations being provided. In principle, make-up exams will not be provided. • Final letter grades will be on a curve. • A team class project will require a final report and a model airplane with stability demonstration. Details of project will be posted before the Midterm Exam 1. • Other remarks: o Any person caught plagiarizing or cheating in this course will get the letter grade F, regardless of their previous grade. For the University definition of plagiarism, see the Student Code of Conduct at http://www.nmsu.edu/~vpsa/SCOC/intro.html). o Students with disabilities: Feel free to contact Diana Quintana (Director, University Disability Services; diquinta@nmsu.edu or 575-646-2400) with any questions on student issues related to the Americans with Disabilities Act and/or Section 504 of the Rehabilitation Act of 1973. All medical information will be treated confidentially.
AUTHOR/DATE:	Y. Lee January 2012

Course Information	**AE 419 Propulsion** 3 credits Required Spring 2012
INSTRUCTOR:	Dr. Chunpei Cai Office: JH515 Phone: 646-7704 email: ccai@nmsu.edu
ASSISTANTS:	NA
OFFICE HOURS:	9:30 a.m.- 12:00 p.m. MWF or by appointment
CATALOG DESCRIPTION:	Propulsion systems, thermodynamic cycles, combustion, specific impulse; principles of gas turbines, jet engines, and rocket propulsion systems.
PREREQUISITES:	AE 439
TEXT:	*Mechanics and Thermodynamics of Propulsion, Hill & Peterson, Addison-Wesley, 1992*
CLASS SCHEDULE:	Lecture: 1:10 p.m. - 2:25 a.m. - TR - JH 203
GRADES:	Quizzes 5% Homework 25% 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 • General Introduction to Air-Breathing Engines • Inlet, nozzle, combustor, axial compressor and axial turbines • Introduction to Rocket Engines
RELATIONSHIP TO PROGRAM EDUCATIONAL OBJECTIVES:	A mastery of the fundamentals of aerospace engineering B ability to formulate, analyze, and creatively participate in the solution of multidisciplinary problems through use of modern engineering
RELATIONSHIP TO PROGRAM OUTCOMES:	a ability to apply knowledge of mathematics, science, and engineering e ability to identify, formulate, and solve engineering problems

Course Information	**AE 419 Propulsion** 3 credits Required Spring 2012
	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:	**<u>Homework</u>** • Homework will be assigned in class in Friday. Completed homework must be turned in before 5:00pm the following Friday. Graded homework will be returned next Monday after they are turned in along with the solution set attached to your returned homework. Late homework turned in before the solution set is given out will earn a maximum of 60% of the full score. Late homework after the solution set is given out will not be accepted. Discussions among classmates on homework are allowed, but students must finish their own homework by themselves. Copying classmates' homework solution is considered serious cheating. **<u>Exams</u>** • One midterm and one final: time, date, place, content and format are TBD. Must sign pledge: "During this exam, I have neither given nor received any aids to/from other people." **<u>How to do well:</u>** • turn in hw; discuss with friends; study example test problems and solutions carefully; always stop by to ask questions if you are not sure about the answers. **<u>Students with Disabilities</u>** • If you have or believe you have a disability, you may wish to self-identify. You can do so by providing documentation to the Office for Services for Students with Disabilities, located at Corbett Center, room 244. Their phone number is 646-6840. Appropriate accommodations may then be provided for you. If you have a condition which may affect your ability to exit safely from the premises in an emergency or which may cause an emergency during class, you are encouraged to discuss this in confidence with the instructor and/or the director of Disabled Student Programs. If you have general questions about the Americans With Disabilities ACT (ADA), call 646-3333. As an instructor I will receive specific written guidelines for appropriate accommodations for individual students from the Coordinator of Disabled Student Programs. Students will be given accommodations for disabilities as requested by the Coordinator.
AUTHOR/DATE:	C. Cai January 2012

Course Information	**AE 428 Aerospace Capstone Design** 3 credits Required Spring 2012
INSTRUCTOR:	Dr. Young H. Park Office: JH615 Phone: 646-3092 email: ypark@nmsu.edu
ASSISTANTS:	To be announced
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 - HA 104 3:30 p.m. - 6:20 p.m. - W - JH 283
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.

Course Information	**AE 428 Aerospace Capstone Design** 3 credits Required Spring 2012
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:	AE1 knowledge covering aeronautical or astronautical engineering areas AE3 design competence
POLICIES:	• None
AUTHOR/DATE:	Y. Park January 2012

Course Information	**AE 424 Aerospace Systems Engineering** 3 credits Required Spring 2012
INSTRUCTOR:	Dr. Ou Ma Office: JH111 Phone: 646- 6534 email: oma@nmsu.edu
ASSISTANTS:	Angel Flores-Abad
OFFICE HOURS:	9:30 a.m.- 12:00 p.m. MWF 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, JR status
TEXT:	Instead of a single textbook, the following materials and reference will be used: • Lecture presentations and notes • NASA Systems Engineering Materials: http://spacese.spacegrant.org/ • *Systems Engineering and Analysis, Blanchard and Fabrycky, 4th edition, 2006* • *An Introduction to General Systems Thinking, Gerald M. Weinberg, 2001*
CLASS SCHEDULE:	Lecture: 10:20 a.m. - 11:35 a.m. - TR - JH 205
GRADES:	Homework 25% Case study project 25% Quizzes 20% Final exam 30%
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

Course Information	**AE 424 Aerospace Systems Engineering** 3 credits Required Spring 2012
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)
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:	O. Ma January 2012

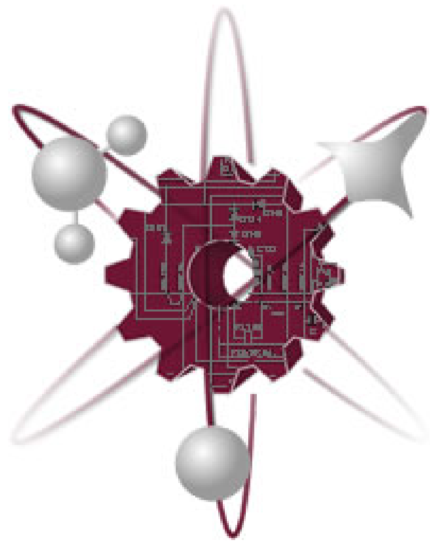
Course Information	**AE 439 Aerodynamics II** 3 credits Required Spring 2012
INSTRUCTOR:	Dr. Fangjun Shu Office: JH629 Phone: 646- 2118 email: shu@nmsu.edu
ASSISTANTS:	Jonathan A. Alcantar (grader)
OFFICE HOURS:	1:00 p.m.- 3:00 p.m. T 2:00 p.m.- 4:00 p.m. R or by appointment
CATALOG DESCRIPTION:	Principles 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, 4th ed., John D. Anderson, Jr.*
CLASS SCHEDULE:	Lecture: 10:30 a.m. - 12:20 a.m. - MWF - JH 103
GRADES:	Homework 20% 2 midterm exams (25% ea.) 50% 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.

Course Information	**AE 439 Aerodynamics II** 3 credits Required Spring 2012
	• Subsonic and supersonic compressible flow is applied to airfoils using linear theory.
RELATIONSHIP TO PROGRAM 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:	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
POLICIES:	• None
AUTHOR/DATE:	F. Shu January 2012

Course Information	**AE 447 Aerofluids Laboratory** 3 credits Required Spring 2012
INSTRUCTOR:	Bashar Qawasmeh Office: JH104 Phone: 646-6252 email: bashar@nmsu.edu
ASSISTANTS:	NA
OFFICE HOURS:	10:00 a.m.- 11:00 p.m. MW 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, AE 339, and AE 364
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 same text you used in ME 345.* • *Experimental Methods for Engineers" by J.P. Holman, 7th Ed. McGraw-Hill (International Edition).* • *Fundamentals of Aerodynamics" by J.D. Anderson, 4th Ed. McGraw-Hill. This is the same text you used in AE 439.* • *Theory of Wing Sections" by I.H. Abbott and A.E. von Doenhoff, 1st Ed. McGraw-Hill, 1949.* • *Shock Tubes" by J.K. Wright, John Wiley and sons, 1961.*
CLASS SCHEDULE:	Lecture: 8:30 a.m. - 9:20 a.m. - MW - JH 205 Lab: 12:30 p.m. - 3:20 a.m. – M, W, or F – JH 168
GRADES:	Class Participation 5% Six Laboratory Reports 50% Seven Quizzes 25% Final Exam 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. • Write technical reports about aerodynamic experiments and make oral presentations.
TOPICS COVERED:	• Flow Visualization • Lift and Drag of Wings • Pressure Distribution Around Wings • Supersonic Flow from Nozzles

Course Information	**AE 447 Aerofluids Laboratory** 3 credits Required Spring 2012
	• Boundary Layers • Shock Tubes
RELATIONSHIP TO PROGRAM 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:	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:	• Lab reports will be due one week after the completion of the Lab by 4:30pm. Late reports will be accepted up to 5 days with a grade reduction of 10 points per day. • Student is responsible for content of all reading assignments and lectures, i.e. quiz content will be taken from these reading assignments, lecture notes as well as the laboratory work.
AUTHOR/DATE:	B. Qawasmeh January 2012

Chemical Engineering Courses



Course Number and Name: Ch E 111: Introduction to Computer Calculations in Chemical Engineering

Credits and Contact Hours:	3
Instructor:	Jessica Houston
Textbook:	MATLAB for Engineers 2/E; Holly Moore; Pearson Prentice Hall, 2008 Introduction to MathCAD 15 2/E; Ronald W. Larsen; Pearson Prentice Hall, 2011

Specific course information

catalog description	Introduction to the use of computer software to solve engineering problems. Chemical engineering majors must earn a C or better.
Pre- and co-requisites:	MATH 121 or MPL greater than or equal to 4.
Required/elective/selected	Required for EP students with Chemical concentration

Specific goals for the course: The central goal of this course is for students to develop competency in the use of the primary computational tools used in the Chemical Engineering Curriculum including structured programming, spreadsheeting, and mathematical software.

outcomes of instruction	• Program effectively with the Matlab7 software using built-in functions; operations; arrays; functions; plotting; logical statements; and structured programming with looping operations. • Perform spreadsheet-based calculations and operations with Excel by formatting cells, rows, columns, and sheets; graphing functions and regressing data; solving formulas; utilizing functions; implementing logical statements; and performing filters and sorts. • Program effectively with MathCad software by defining variables, functions, ranges, vectors matrices; building expressions; creating graphs; formatting areas; using/converting units; data analysis by linear regression; solving an equation in a single unknown; solving a system of linear/non-linear equations; finding the roots of a polynomial; symbolic solutions of equations; simple programming operations.
Student outcomes addressed:	a, k
Brief list of topics to be covered	1. MATLAB programming 2. MathCAD programming 3. Microsoft Excel

Course Number and Name: Ch E 201: Material and Energy Balances

Credits and Contact Hours:	4 (2+2P)
Instructor:	David Rockstraw
Textbook:	Elementary Principles of Chemical Processes, 3rd Update Edition, Richard M. Felder and Ronald W. Rousseau, 2005

Specific course information

catalog description	Chemical Engineering basic problem-solving skills; unit conversions; elementary stoichiometry; material balances; energy balances; combined energy and material balances including those with chemical reaction, purge and recycle; thermochemistry; application to unit operations. Sources of data. Introduction to the first law of thermodynamics and its applications. Chemical engineering majors must earn C or better in this course. Restricted to CH E majors.
Pre- and co-requisites:	CHEM 115 or CHEM 111G, Ch E 111 and MATH 192G
Required/elective/selected	Required for EP students with Chemical concentration

Specific goals for the course

outcomes of instruction	Student will be able to apply concepts in topics covered
student outcomes addressed	a, c, d, e, g, k
Brief list of topics to be covered	units and conversions; data analysis; process classification; balances and flowcharts; degree of freedom analysis; general material balance; material balances; recycle and by-pass; limiting/excess reactant; fractional conversion; chemical equilibrium; molecular/atomic balances; extent of reaction; combustion reactions; non-ideal gas equations of state; compressibility; chemical equilibria; Gibbs phase rule; condensable components; liquid solutions and solubility; forms of energy; first law of thermodynamics; closed system energy balance; open system energy balance; the steam tables; energy balance calculations; phase changes and latent heat; psychometric charts; adiabatic cooling; mixing and solution; heat of reaction; heat of formation; heat of combustion; reactive processes energy balance; adiabatic reactors; solution thermochemistry; fuels and combustion; adiabatic flame temperature; flammability and ignition; and flames and detonations.

Course Number and Name: Ch E 301: Chemical Engineering Thermodynamics I

Credits and Contact Hours:	3
Instructor:	Hongmei Luo
Textbook:	Sandler, Stanley I., *Chemical, Biochemical, and Engineering Thermodynamics*, 4th edition, John Wiley and Sons, 1999, ISBN# 0-471-66174-0.

Specific course information

catalog description	Applications of the first and second law to chemical process systems, especially phase and chemical equilibrium and the behavior of real fluids. Development of fundamental thermodynamic property relations and complete energy and entropy balances. Chemical engineering majors must earn C or better in this course.
Pre- and co-requisites:	CH E 201 and MATH 291
Required/elective/selected	Required for EP students with Chemical concentrations

Specific goals for the course: This course is one of the core courses in the Chemical Engineering curriculum that satisfies the professional component to enable graduates to design, analyze and control physical, chemical and biological processes consistent with program objectives to provide all graduating B.S. students with a solid foundation in the fundamentals of chemical engineering science, design, and practice.

outcomes of instruction	At the end of this course the student will be able to: • Define a system, outcome (a) an ability to apply knowledge of mathematics, science, and engineering; • Solve problems using the energy balance appropriate for a system (the First Law of Thermodynamics), outcome (e) an ability to identify, formulate and solve engineering problems; • Solve problems using the entropy balance appropriate for a system (the Second Law of Thermodynamics), outcome (e) an ability to identify, formulate and solve engineering problems; • Evaluate, manipulate and use thermodynamic partial derivatives, outcome (a) an ability to apply knowledge of mathematics, science, and engineering; • Correctly use a thermodynamic property chart and the steam tables, outcome (a) an ability to apply knowledge of mathematics, science, and engineering and outcome (k) an ability to use the

	techniques, skills, and modern engineering tools necessary for engineering practice • As a team, choose a process related to energy production or refrigeration, and present a description of the process, including mass, energy and entropy balances, via written and oral presentations, outcome (d) an ability to function on multidisciplinary teams, (e) an ability to identify, formulate and solve engineering problems and outcome (g) an ability to communicate effectively.
student outcomes addressed	a, d, e, g, k
Brief list of topics to be covered	1. Conservation of Mass 2. Application of Mass Balance 3. The First Law of Thermodynamics, Conservation of Energy 4. Application of Energy Balance 5. Entropy, the Second Law of Thermodynamics 6. Application of Entropy Balances 7. Steam Table 8. Heat, Work, Engines 9. Power and Refrigeration Cycles 10. Thermodynamics Fundamental Equations 11. Evaluation of Thermodynamic Partial Derivatives 12. Ideal Gas 13. Equation of State 14. Criteria for Equilibrium 15. Stability of Thermodynamic systems 16. The Third Law of Thermodynamics

Course Number and Name: Ch E 302: Chemical Engineering Thermodynamics II

Credits and Contact Hours:	2
Instructor:	Martha Mitchell
Textbook:	Sandler, Stanley I., *Chemical, Biochemical, and Engineering Thermodynamics*, 4th edition, John Wiley and Sons, 1999, ISBN# 0-471-66174-0.

Specific course information

catalog description	Continuation of CH E 301. Chemical engineering majors must earn C or better in this course.
Pre- and co-requisites:	CH E 301 and MATH 392
Required/elective/selected	Required for EP students with Chemical concentration

Specific goals for the course: This course is one of the core courses in the Chemical Engineering curriculum that satisfies the professional component to enable graduates to design, analyze and control physical, chemical and biological processes consistent with program objectives to provide all graduating B.S. students with a solid foundation in the fundamentals of chemical engineering science, design, and practice.

outcomes of instruction	At the end of this course the student will be able to: • State and apply the First and Second Laws of thermodynamics to open and closed systems (student outcome (e) an ability to identify, formulate, and solve engineering problems) • Use departure functions to solve First and Second Law problems for non-ideal systems (student outcome (e) an ability to identify, formulate, and solve engineering problems) • State the conditions of equilibrium for multiphase systems (student outcome (a) an ability to apply knowledge of mathematics, science, and engineering) • Understand and apply fugacity to phase equilibria problems (student outcome (a) an ability to apply knowledge of mathematics, science, and engineering) • Compute the vapor pressure for single-component multiphase systems (student outcome (a) an ability to apply knowledge of mathematics, science, and engineering) • Apply partial molar quantities to compute mixture properties (student outcome (a) an ability to apply knowledge of mathematics, science, and engineering) • Know and apply models for excess Gibbs free

	energy in nonideal mixtures (student outcome (a) an ability to apply knowledge of mathematics, science, and engineering) • Construct binary phase diagrams for multiple phase systems correcting for nonideal behavior using fugacity coefficients and activity coefficients (student outcome (a) an ability to apply knowledge of mathematics, science, and engineering) • Perform bubble and dewpoint calculations for vapor-liquid equilibria (student outcome (a) an ability to apply knowledge of mathematics, science, and engineering) • Determine the equilibrium composition for a reacting system given the reaction stoichiometry, temperature and pressure (student outcome (a) an ability to apply knowledge of mathematics, science, and engineering)
student outcome addressed	a, e
Brief list of topics to be covered	1. Review of the First and Second Laws of Thermodynamics 2. Review of nonideal fluids and estimation of thermodynamic properties using equations of state and departure functions 3. Equilibrium and stability in one-component systems 4. Thermodynamics of multicomponent mixtures 5. Estimation of Gibbs energy and fugacity of components in mixtures (including activity coefficient models) 6. Multiphase equilibrium in mixtures (vapor-liquid, liquid-liquid, vapor-liquid-liquid) 7. Phase equilibria in systems including solids 8. Chemical equilibrium

Course Number and Name: Ch E 302L: Thermodynamic Models of Physical Properties

Credits and Contact Hours:	1 (3P)
Instructor:	Martha Mitchell
Textbook:	none

Specific course information

catalog description	Computational analysis of thermodynamic models in a chemical process simulator, and comparison to experimental data. Specification of pseudo-components. Generation of physical properties by group contribution methods.
Pre- and co-requisites:	CH E 302 (corequisite)
Required/elective/selected	Required for EP students with Chemical concentration

Specific goals for the course

outcomes of instruction	At the end of this course the student will be able to: • Use MathCAD to calculate one-component properties using cubic equations of state (student outcome (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering) • Use MathCAD to ompute the vapor pressure for single-component systems • Use MathCAD to calculate fugacity coefficients for mixture equations of state (student outcome (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering) • Use MathCAD to calculate activity coefficients (student outcome (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering) • Use MathCAD to calculate bubble and dewpoints coefficients (student outcome (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering) • Use Visual Basic program UNIFAC to determine mixture properties from group contribution methods (student outcome (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering) • Use AspenPlus (flowsheeeting software) to analyze thermodynamic models and compare to experimental data, to specify pseudo-components

	and generate physical properties by group contribution methods methods (student outcome (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering)
student outcomes addressed:	k
Brief list of topics to be covered	1. Use of MathCAD to predict single-component properties for cubic equations of state (enthalpy, entropy, specific volume, fugacity) 2. Use of MathCAD to predict multi-component properties (fugacity coefficients, activity coefficients) 3. Use of UNIFAC (through a Virtual Basic interface) to predict multi-component mixture properties 4. Use of ASPEN to predict single component properties, such as vapor pressure 5. Use of ASPEN to predict multi-component mixture properties 6. Use of ASPEN to predict vapor-liquid equilibrium

Course Number and Name: Ch E 305: Transport Operations I: Fluid Flow

Credits and Contact Hours:	3
Instructor:	Paul Andersen
Textbook:	Andersen (2012) *Fluid Mechanics: Theory and Applications*, 2012 Edition (available on line).

Specific course information

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. Chemical engineering majors must earn C or better in this course.
Pre- and co-requisites:	CH E 201, MATH 291G, MATH 392 (corequisite)
Required/elective/selected	Required for EP students with the Chemical concentration

Specific goals for the course

outcomes of instruction	Students successfully completing this course will demonstrate the ability to do the following: **1. Basic Concepts.** Write and explain the meanings of the basic balances and equations of fluid mechanics. [Outcome 3(a)] **2. Model Building.** Given a verbal or pictorial description, create useful mathematical models of engineering flow systems. [3(e)] **3. Problem Solving.** Solve problems involving mass, energy, momentum balances, fluid forces, etc. [3(a)(e)] This course addresses the following student outcomes from ABET Criterion 3: (a) Ability to apply knowledge of mathematics, science, and engineering (e) Ability to identify, formulate, and solve engineering problems
student outcomes addressed	a, e

List of topics to be covered	• Balances • Supplemental relations • Mass • Energy • Entropy and free energy • Momentum • Static fluid forces • Dynamic fluid forces • Dimensionless parameters and scale-up • Lift and drag • Flow in conduits • Friction • Fluid machinery

Course Number and Name: Ch E 306: Transport Operations II: Heat and Mass Transfer

Credits and Contact Hours:	3
Instructor:	Shuguang Deng
Textbook:	Frank P. Incropera and David P. DeWitt "Fundamentals of Heat and Mass Transfer" 6^{th} Edition, John Wiley & Sons, 2007 (ISBN: 0-471-45728-0)

Specific course information

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. Chemical engineering majors must earn C or better in this course.
Pre- and co-requisites:	CH E 305, MATH 392
Required/elective/selected	Required for EP students with Chemical concentration

Specific goals for the course: for students to learn to apply the fundamentals of transport phenomena to solve problems relevant to chemical engineering practice: energy and mass transfer. In each case, we will work through examples that help to explore both the intuitive concepts and the formal mathematical framework necessary to make predictions. Transport phenomena, along with thermodynamics and reactor design, define the fundamental skill set necessary for solving the challenging problems that arise in the chemical engineering profession.

outcomes of instruction	At the completion of this course, the students will be able to (the mapping of these objectives to ABET outcomes a-k): • Set up microscopic and macroscopic energy and mass balances (conservation principles) (a, e); • Know the flux laws for heat and mass transport (a, c, e); • Apply the conservation principles and flux laws to model transport processes central to chemical engineering (a, c, e); • Use the physical and mathematical similarities between the processes of heat and mass transfer to solve new problems "by analogy" (a, c, e); • Perform basic unit operation design calculations for heat and mass transfer equipment (a, c, e)
student outcomes addressed	a, c, e

Brief list of topics to be covered	• Heat Transfer • Conservation of Energy • 1-D and 2-D Steady-State Conduction • Transient Conduction • Convection Heat Transfer • Heat and Mass Transfer Analogies • Internal and External Flow • Free Convection • Boiling and Condensation • Heat Exchangers • Mass Transport in Non-stationary Media • Conservation Equations and Concentrations at Interfaces • Diffusion with Homogeneous Chemical Reactions • Transient Diffusion

Course Number and Name: Ch E 361: Engineering Materials

Credits and Contact Hours:	3
Instructor:	M. Ginger Scarbrough
Textbook:	*Materials Science and Engineering, An Introduction* 8/e; Callister and Rethwisch; John Wiley and Sons, 2009

Specific course information

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.
Pre- and co-requisites:	CHEM 111 or 114 or 115
Required/elective/selected	Required for EP students with Chemical concentration

Specific goals for the course

Outcomes of instruction	At the completion of this course, students will be able to: analyze the interrelationship between chemical bonding and composition, structures, and processes (including heat treatments and mechanical strengthening mechanisms) and their effect on material properties (mechanical, thermal, and electrical); select materials, given specific design parameters; and evaluate and discuss economic, environmental, and societal issues in Materials Science and Engineering.
Student outcomes addressed	a, h
Brief list of topics covered	1) Introduction to Materials Engineering 2) Atomic Structure & Bonding 3) Crystal Structure & Geometry 4) Crystalline Imperfections 5) Diffusion 6) Mechanical Properties 7) Dislocation Strengthening 8) Failure 11) Thermal Processing 12) Ceramics & Applications 13) Polymers & Applications 14) Nanotechnology 15) Composites 16) Electrical Properties 17) Corrosion

Course Number and Name: Ch E 441: Chemical Kinetics and Reactor Engineering

Credits and Contact Hours:	3
Instructor:	David Rockstraw
Textbook:	Elements of Chemical Reaction Engineering, 4th ed., H. Scott Fogler, 2007

Specific course information

catalog description	Chemical Kinetics and Reactor Engineering, 3 cr.; 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.
Pre- and co-requisites:	CHEM 314; CH E 306; CH E 307 (co-requisite)
Required/elective/selected	Required for EP students with Chemical concentration

Specific goals for the course

outcomes of instruction	At the completion of this course, students will be able to: perform mole balances in systems involving chemical reaction; calculate conversion in batch and flow systems; size single and staged continuous-stirred tank, and plug flow reactors; develop rate laws from mechanisms and experimental data; calculate pressure drops and the effect on kinetics in packed-bed PFRs; apply the differential and integral methods of kinetic data analysis; maximize product selectivity for systems involving multiple reactions; understand effects of non-isothermal operation and unsteady-state behavior; apply rate limiting step and quantify performance in catalytic systems, quantify mass transfer limitations on heterogeneous systems, and understand the idea of a residence time distribution, and the effect on reactor ideality.
student outcomes addressed	a, e
Brief list of topics to be covered	Design/Performance Equations; Reaction Conversion; Isothermal Reactor Design; Rate Laws/Stoichiometry; Kinetic Data Analysis; Multiple Reactions; Unsteady State, Nonisothermal, and Nonadiabatic Reactor Operation; Effect of Mass Transfer Resistance on Heterogeneous Reactions; Catalysis and Catalyst Deactivation, Design and Analysis of Catalytic Reactors; Residence Time Distributions; Nonideal Reactor Models

Electrical Engineering Courses

Course number and name: EE 161 Computer Aided Problem Solving

2. Credits and contact hours: 4 credits. Each week has three lectures of 50 minutes each and a lab session of 2 hours and 30 min.

3. Instructor's or course coordinator's name: Dr. Hong Huang

4. Textbook, title, author and year: *Problem Solving and Program Design in C*, 6th Edition, Jeri R. Hanly and Elliot B. Koffman, 2010

a. Other supplemental materials: None

5. Specific course information:

a. brief description of the content of the course (catalog description): The course is an introduction to scientific programming. Extensive practice in writing programs to solve engineering problems. Items covered will include: loops, input and output, functions, decision statements, and pointers.

b. prerequisites or co-requisities: Math 190G

c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: This is a required class for Engineering Physics students with the Electrical concentration.

6. Specific goals for the course:

a. specific course objectives:

- Understanding and interpreting problem statements by designing algorithms, based on problem statements that render correct solutions and implementing those algorithms as computer programs.
- Inputting and outputting data through both interactive and file mechanisms. Controlling program execution through decision statements and loops. Creating and calling user-defined routines with arguments passed by value and by reference. Performing operations using arrays, pointers, and data structures.
- Working and learning in teams in the lab environment.

b. explicitly indicate which of the program outcomes are addressed by the course:

- Functioning effectively on teams - ABET outcome 3(d)
- Identifying, formulating, and solving engineering problems - ABET outcome 3(e)
- Communicating effectively - ABET outcome: 3(g)
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice - ABET outcome: 3(k)

7. Brief list of topics to be covered:

- C program structure
- Input and output data in the interactive mode and the batch mode (through files)
- Top-down design with functions
- Selection structures
- Repetition and loops
- Function call by value and by reference
- Arrays, pointers and data structures

1. Course number and name: EE 162 Digital Circuit Design

2. Credits and contact hours: 4 credits (3+3P). Three 50 minute lectures each week, and a 2½ hour weekly lab.

3. Instructor: Dr. Krist Petersen

4. Textbook: *Fundamentals of Digital Logic with VHDL Design*, 3rd Edition, 2009 By Stephen Brown and Zvonko Vranesic, ISBN-10 : 0-07-352953

a. Other supplemental materials: None

5. Specific course information:

a. catalog description: Design of combinational logic circuits based on Boolean algebra. Introduction to state machine design. Implementation of digital projects with hardware description language.

b. prerequisites: C or better in EE 161 (C programming) and MATH 190G (trigonometry).

c. This is a required class for Engineering Physics students with the Electrical concentration.

6. Specific goals for the course:

a. specific outcomes of instruction: To earn a grade of C, or better, students must satisfactorily demonstrate the following proficiencies:

- Use Ohm's Law to solve basic voltage and current problems for resistors in series and parallel.
- Use Boolean algebra, truth tables, and Karnaugh maps to manipulate logical expressions.
- Design combinational logic circuits to meet specific requirements.
- Represent numeric values in different bases. Convert values between bases. Perform logical and arithmetic operations with binary numbers.
- Analyze Finite State Machines, including registers, counters, and shifters.
- Use VHDL to program FPGA's to meet specific design requirements.

b. student outcomes addressed: The course goals address the following student outcomes:

- Applying knowledge of mathematics (including probability and statistics, differential and integral calculus, differential equations, linear algebra, and complex variables); science (chemistry, physics, and computer science); and engineering to the design and/or analysis of analog and digital circuits, signals and systems, electromagnetics, and electric power systems - ABET outcome 3(a)
- Designing a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability - ABET outcome 3(c)
- Functioning effectively on teams ABET outcome 3(d)
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice ABET outcome 3(k)

7. Brief list of topics to be covered:

- Binary numbers
- Truth tables
- Logic gates
- Boolean algebra
- Circuit synthesis
- Algebraic minimization
- Karnaugh maps
- Don’t care conditions
- Circuit analysis
- Numeric representations
- Multiplexors/Demultiplexors
- Feedback
- State diagrams
- Flip-flops
- State machines
- State minimization
- Registers, counters, & shifters
- Voltage, current, & resistance
- Ohm’s law
- Series & parallel circuits
- Pull-up, pull-down, & current-limiting resistors
- Laboratory topics: VHDL

1. Course number and name: EE 210 Engineering Analysis I

2. Credits and contact hours: 4 credits (3+3P). Each week has three lectures of 50 minutes each and a 2.5 hour lab.

3. Instructor's or course coordinator's name: Dr. Charles D. Creusere

4. Textbook, title, author and year:

- S. Lipschutz and M. Lipson, *Schaum's outlines Linear Algebra*, 4th Ed., McGraw Hill, 2009.
- H. Hsu, *Probability, Random Variables, and Random processes*, McGraw Hill, 2nd Ed.
- A. Gilat, *MATLAB an introduction with applications*, 4th Ed., JohnWiley & Sons. Inc., 2011.

a. Other supplemental materials:

References: R. D. Yates and D. J. Goodman, *Probability and Stochastic Processes: A friendly introduction for electrical and computer engineers*, John Wiley & Sons. Inc., 2005.

Software: Matlab 7.5 or higher

5. Specific course information:

a. brief description of the content of the course (catalog description): The application of linear algebra and matrices, probability, random variables and random processes to solve problems in electrical engineering. Applications to be covered include probabilistic modeling of electrical/electronic systems and an introduction to Matlab.

b. prerequisites: C or better in EE 161 and MATH 192G.

c. indicate whether a required or elective course: This is a required class for Engineering Physics students with the Electrical concentration.

6. Specific goals for the course:

a. specific course objectives:

- Perform vector and matrix operations, including matrix inversion, eigenvalue analysis, finding basis and dimension of vector spaces and rank of a matrix, and solving a set of linear equations.
- 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.
- Perform simple parameter estimation, such as finding sample mean and variance, and relate to confidence intervals.
- Describe random processes in the context of signal processing and communications systems problems.
- Use MATLAB to solve problems involving linear algebra and probability, including designing and performing simple numerical experiments.

b. explicitly indicate which of the program outcomes are addressed by the course:

- Applying knowledge of mathematics (including probability and statistics, differential and integral calculus, differential equations, linear algebra, and complex variables); science (chemistry, physics, and computer science); and engineering to the design and/or analysis of analog and digital circuits, signals and systems, electromagnetics, and electric power systems - ABET outcome: 3(a)
- Designing and conducting experiments to simulate, test, validate, and/or verify - ABET outcome: 3(b)

- Identifying, formulating, and solving engineering problems – ABET outcome: 3(e)
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice - ABET outcome: 3(k)

7. Brief list of topics to be covered:

- Vectors, matrices and matrix operations
- System of linear equations
- Vector spaces
- Eigenvalues and eigenvectors
- Probability axioms, conditional probabilities, Bayes' rule and applications
- Random variables, distribution and density functions
- Special distributions including Gaussian
- Multiple random variables
- Parameter estimation and confidence coefficient
- Random processes
- Laboratory topics will cover Matlab command window and environment, script files and data management, two-dimensional plots, conditional statements, logical operators and nested loops, function files, and solving problems for applications in parameter estimation and probability.

1. Course number and name: EE 260 Embedded Systems

2. Credits and contact hours: 4 credits (3+3P). Each week has three lectures of 50 minutes each and a 2.5 hour lab.

3. Instructor's or course coordinator's name: Dr. Hong Huang

4. Textbook, title, author and year:
TBA

5. Specific course information:

a. brief description of the content of the course (catalog description): Applications of microcontrollers, FPGAs, interfaces and sensors, introductionto language programming

b. prerequisites: C or better in EE 162

c. indicate whether a required or elective course: This is a required class for Engineering Physics students with the Electrical concentration.

6. Specific goals for the course:

a. specific course objectives:

EE 260 is a new class for digital electronics. The class is being designed to introduce microcontrollers with a view towards studying embedded systems. This class will also utilize the C programming from EE 161.

b. explicitly indicate which of the program outcomes are addressed by the course:

- Applying knowledge of mathematics (including probability and statistics, differential and integral calculus, differential equations, linear algebra, and complex variables); science (chemistry, physics, and computer science); and engineering to the design and/or analysis of analog and digital circuits, signals and systems, electromagnetics, and electric power systems - ABET outcome: 3(a)
- Designing a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability - ABET outcome: 3(c)
- Identifying, formulating, and solving engineering problems – ABET outcome: 3(e)
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice - ABET outcome: 3(k)

7. Brief list of topics to be covered:
TBA

1. Course number and name: EE 280 DC and AC circuits

2. Credits and contact hours: 4 credits (3+3P). Each week has three lectures of 50 minutes each and a 2.5 hour lab.

3. Instructor's or course coordinator's name: Dr. Hong Huang

4. Textbook, title, author and year:
TBA

5. Specific course information:

a. brief description of the content of the course (catalog description): Electric component descriptions and equations.Kirchhoff's voltage and current laws, formulation and solution of network equations in the time and frequency domain. Applications of circuit analysis to ideal op amps. Complete solutions of RLC and switching networks. Mutual coupling.

b. prerequisites: C or better in MATH 192G and PHYS216G

c. indicate whether a required or elective course: This is a required class for Engineering Physics students with the Electrical concentration.

6. Specific goals for the course:

a. specific course objectives:

Combining the old EE 111 and EE 211 into a single course EE 280. This course occurs later in the sequence to allow the students to have the proper mathematics and physics preparation so that the basic circuit analysis for RLC components can be covered in a single semester. This will allow for articulation with the other programs in the state..

b. explicitly indicate which of the program outcomes are addressed by the course:

- Applying knowledge of mathematics (including probability and statistics, differential and integral calculus, differential equations, linear algebra, and complex variables); science (chemistry, physics, and computer science); and engineering to the design and/or analysis of analog and digital circuits, signals and systems, electromagnetics, and electric power systems - ABET outcome: 3(a)
- Designing and conducting experiments to simulate, test, validate, and/or verify - ABET outcome: 3(b)
- Designing a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability - ABET outcome: 3(c)
- Identifying, formulating, and solving engineering problems – ABET outcome: 3(e)
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice - ABET outcome: 3(k)

7. Brief list of topics to be covered:
TBA

1. **Course number and name:** EE 310 Engineering Analysis II

2. **Credits and contact hours:** 3 credits. Each week has two lectures of 75 minutes each.

3. **Instructor's or course coordinator's name:** Dr. Kwong T. Ng

4. **Textbook, title, author and year:** David K. Cheng, *Fundamentals of Engineering Electromagnetics*, Prentice Hall, 1993.

   a. Other supplemental materials: References: Harry M. Schey, *div, grad, curl, and all that*, 4th Ed., W.W. Norton & Company, 2005; Software: Matlab 7.5 or higher

5. **Specific course information:**

   a. Brief description of the content of the course (catalog description): Calculus of vector functions through electrostatic applications. Techniques for finding resistance and capacitance. Coulomb's law, gradient, Gauss divergence theorem, curl, Stokes' theorem, and Green's theorem. Application of complex algebra and Matlab.

   b. Prerequisites: C or better in EE 210 and MATH 291G.

   c. Indicate whether a required or elective course: This is a required class for Engineering Physics students with the Electrical concentration. It can be substituted by PHYS 461.

6. **Specific goals for the course:**

   a. specific course objectives:

   - To learn and apply techniques in differential and integral vector calculus.
   - To learn how to use vectors to perform analysis and solve problems with different coordinate systems.
   - To learn complex arithmetic and complex algebra.
   - To apply vector calculus techniques to calculate static fields and analyze their behavior in engineering problems.

b. explicitly indicate which of the program outcomes are addressed by the course:

- Applying knowledge of mathematics, science and engineering to the design and/or analysis of analog and digital circuits, signals and systems, electromagnetics, and electric power systems - ABET outcome: 3(a)
- Identifying, formulating, and solving engineering problems - ABET outcome: 3(e)
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice - ABET outcome: 3(k)

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

- Vector algebra, orthogonal coordinate systems
- Vector differential operators
- Line integral, surface integral and volume integral
- Vector theorems
- Static field theory
- Vector field calculations in free space and dielectrics
- Electric potential and its evaluation
- Circuit quantities and their calculation
- Complex arithmetic and algebra

1. Course number and name: EE 312 Signals and Systems I

2. Credits and contact hours: 3 credits. Each week has two lectures of 75 minutes each and two voluntary problem solving sessions, one hour each.

3. Instructor's or course coordinator's name: Dr. Joerg Kliewer

4. Textbook, title, author and year: Alan V. Oppenheim and Alan S. Willsky, *Signals & Systems*, 2nd Edition, Prentice Hall, 1997

a. Other supplemental materials: Software: Matlab 7.5 or higher

5. Specific course information:

a. brief description of the content of the course (catalog description): Continuous- and discrete-time signals and systems. Time- and frequency- characterization of signals and systems. Transform-domain methods including Fourier-, Laplace-, and z-transforms.

b. prerequisites: C or better in EE 210, EE 280, and MATH 392.

c. indicate whether a required or elective course: This course is a required course for Engineering Physics students with the Electrical concentration

6. Specific goals for the course:

a. specific course objectives:

- Understanding different types of signals (continuous-time, discrete-time, periodic, etc.) and how these signals are represented mathematically and in a computer.
- Understanding systems representations (e.g., impulse responses), their implementations (e.g., convolution and difference/differential equations), and their properties (e.g., linearity).
- Understanding and being able to apply transform-domain analysis methods for signals and systems.
- Ability to apply transform domain and LTI analysis to simple applications in signal processing, communications, and controls using Matlab.

b. explicitly indicate which of the program outcomes are addressed by the course:

- Applying knowledge of mathematics, science and engineering to the design and/or analysis of analog and digital circuits, signals and systems, electromagnetics, and electric power systems - ABET outcome: 3(a)
- Identifying, formulating, and solving engineering problems -ABET outcome: 3(e)
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice - ABET outcome: 3(k)

7. Brief list of topics to be covered:

- Signals and systems
- Linear time-invariant systems
- Fourier series representation of periodic signals
- The continuous-time Fourier transform
- The discrete-time Fourier transform
- Time and frequency characterizations of signals and systems
- The Laplace transform
- Sampling

1. **Course number and name:** EE 314 Signals & Systems II

2. **Credits and contact hours:** 4 credits (3+3P). Each week has two lectures of 75 minutes each and a 2.5 hour lab.

3. **Instructor's or course coordinator's name:** Dr. Laura E. Boucheron

4. **Textbook, title, author and year:**
   - V. Oppenheim, A. S. Willsky, and S. H. Nawab, *Signals & Systems*, 2nd Ed., Prentice Hall, 1997.
   - J. R. Buck, M. M. Daniel, and A. C. Singer, *Computer Explorations in Signals and Systems Using MATLAB*, 2nd Ed., Prentice Hall, 2002.

   a. **Other supplemental materials:** Software: Matlab 7.5 or higher

5. **Specific course information:**

   a. **Brief description of the content of the course (catalog description):** Introduction to communication systems including amplitude-, frequency-, and pulse-amplitude modulation. Introduction to control systems including linear feedback systems, root-locus analysis, Nyquist criterion. Introduction to digital signal processing including sampling, digital filtering, and spectral analysis.

   b. **Prerequisites:** C or better in EE 312.

   c. **Indicate whether a required or elective course:** This course is a possible elective for Engineering Physics students with the Electrical concentration.

6. **Specific goals for the course:**

   a. **specific course objectives:**
   - To model, analyze, simulate, and perform calculations with continuous- and discrete-time systems.
   - To develop an understanding of basic modulations in communication systems.
   - To gain insight into the basics of control systems.
   - To develop insight into filtering and analysis of digital signals.
   - To learn how to use MATLAB and SIMULINK to perform analysis, design, and simulation of communication, control, and signal processing systems.

   b. **explicitly indicate which of the program outcomes are addressed by the course:**
   - Applying knowledge of mathematics (including probability and statistics, differential and integral calculus, differential equations, linear algebra, and complex variables); science (chemistry, physics, and computer science); and engineering to the design and/or analysis of analog and digital circuits, signals and systems, electromagnetics, and electric power systems - ABET outcome: 3(a)
   - Designing a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability - ABET outcome: 3(c)
   - Identifying, formulating, and solving engineering problems - ABET outcome: 3(e)
   - An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice - ABET outcome: 3(k)

7. Brief list of topics to be covered:

- The sampling theorem
- Interpolation
- Aliasing
- The z-transform
- Analysis and characterization of LTI system using the z-transform
- Complex exponential and sinusoidal amplitude modulation
- Frequency division multiplexing
- Pulse amplitude modulation
- Sinusoidal frequency modulation
- Introduction to digital communications
- Linear feedback systems
- Root-locus analysis of linear feedback systems
- The Nyquist stability criterion
- Gain and phase margins
- Laboratory topics will cover Matlab and Simulink programming to solve problems covering the application of signal processing, communications, and control theory

1. **Course number and name:** EE 363 Computer Systems Architecture
2. **Credits and contact hours:** 4 credits (3+3P). Three 50 minute lectures each week, and a 2½ hour weekly lab.
3. **Instructor:** Dr. Krist Petersen
4. **Textbook:** *Computer Organization and Design: The Hardware/Software Interface*, 4^{th} edition, 2008, By David A. Patterson and John L. Hennessy, ISBN-13 : 978-0-12-374493-7
   - **a. Other supplemental materials:** None
5. **Specific course information:**
   - **a. 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.
   - **b. prerequisites:** C or better in CS 273 (machine programming and organization) or EE 260 (embedded systems).
   - **c.** This course is a possible elective for Engineering Physics students with the Electrical concentration.
6. **Specific goals for the course:**
   - **a. specific outcomes of instruction**: To earn a grade of C, or better, students must satisfactorily demonstrate the following proficiencies:
     - Understand the macro components of a computer system, including displays, keyboards, disk drives, mice, serial & parallel ports, and networks.
     - Understand the micro components of a computer system, including memory, cache, registers, ALU's, pipelines, instruction decoding, and interrupts.
     - Understand the function of an operating system, including file systems, multi-tasking, multi-user, and program execution.
     - Understand the operation of the processor, including the fetch/execute cycle, memory access, virtual memory, addressing modes, data types, instruction sets, and interrupt handling.
     - Understand the relationship between hardware and software.
     - Understand their professional and ethical responsibilities with respect to computer architectural design decisions.
     - Understand the potential global, economic, environmental, and societal impact of their engineering decisions.
     - Awareness of current topics in computer architecture

b. student outcomes addressed: The course outcomes of instruction address the following program student learning outcomes:

- Applying knowledge of mathematics (including probability and statistics, differential and integral calculus, differential equations, linear algebra, and complex variables); science (chemistry, computer science, and physics); and engineering to the design and/or analysis of analog and digital circuits, signals and systems, electromagnetics, and electric power systems - ABET outcome 3(a)
- An understanding of professional and ethical responsibility - ABET outcome 3(f)
- Understanding the impact of engineering solutions in a global, economic, environmental, and societal context - ABET outcome 3(h)
- Maintaining a knowledge of contemporary professional, societal and global issues - ABET outcome 3(j)

7. Topics covered:

- CPU architecture
- Memory interfacing
- Cache strategies
- RISC vs. CISC
- Multi-processors
- Micro-programmed control
- Pipelining
- Address binding
- Memory hierarchies
- Paging
- Virtual memory
- Data types
- Data alignment
- Interrupt handling
- I/O devices
- Asynchronous communication protocols
- Hardware/software interface
- Operating system concepts
- Laboratory topics: MIPS architecture and Simpler Scalar simulator

1. **Course number and name:** EE 380, Electronics I
2. **Credits and contact hours:** 4 credits. Each week has three lectures of 50 minutes each and a 2.5 hour lab.
3. **Instructor's or course coordinator's name:** Dr. Sang-Yeon Cho
4. **Textbook, title, author and year:** *Microelectronic Circuits*, 6th edition, by Adel S. Sedra and Kenneth C. Smith, Oxford University Press, 2010.
   a. Other supplemental materials: None.
5. **Specific course information:**
   a. **Brief description of the content of the course (catalog description):** Analysis and design of single-time-constant circuits, op-amp applications, diode circuits, linear power supplies, and single-transistor MOS and BJT amplifiers. Introduction to solid-state devices and digital CMOS circuits.
   b. **Prerequisites:** C or better in EE162, EE280, and CHEM 111G.
   c. **Indicate whether a required, elective course:** This is a required course for Engineering Physics students with the Electrical concentration.
6. **Specific goals for the course:**
   a. **Specific course objectives:**
   - Analysis and design of single time-constant circuits, opamp circuits, and linear power supplies.
   - Understanding of solid state devices.
   - Biasing and small-signal analysis of MOS and BJT single transistor amplifiers.
   - Using computer tools to simulate electronic circuits and lay out PCBs.
   - Testing electronic circuits using power supplies, function generators, digital multi-meters, and oscilloscopes.
   - Writing and documenting laboratory results and presenting a project in front of peers.

   b. **Explicitly indicate which of the program outcomes are addressed by the course:**
   - Applying knowledge of mathematics (including probability and statistics, differential and integral calculus, differential equations, linear algebra, and complex variables); science (chemistry, physics, and computer science); and engineering to the design and/or analysis of analog and digital circuits, signals and systems, electromagnetics, and electric power systems - ABET outcome: 3(a)
   - Designing a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability - ABET outcome: 3(c)
   - Communicating effectively - ABET outcome: 3(g)
   - An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice - ABET outcome: 3(k)

7. **Brief list of topics to be covered:**
   - Single-time-constant networks
   - Frequency response of amplifiers
   - Difference amplifiers
   - Integrators and differentiators
   - Large-signal operation of Op Amps
   - Semiconductor materials
   - Current flow in semiconductors (Drift and diffusion currents)
   - The pn junction (terminal characteristics, capacitive effects)
   - Modeling of the diode forward characteristics
   - Rectifier circuits
   - Physical operation of metal-oxide-semiconductor field effect transistors
   - MOSFET circuits at DC
   - Biasing and small-signal analysis of MOSFET circuits
   - Physical operation of bipolar junction transistors
   - BJT circuits at DC
   - Biasing and small-signal analysis of BJT circuits
   - Testing electronic circuits using power supplies, function generators, digital multi-meters, and oscilloscopes.
   - Writing and documenting laboratory results and presenting a project in front of peers

1. **Course number and name:** EE 391 Introduction to Electric Power Engineering
2. **Credits and contact hours:** 4 credits (3+3P). Each week has three lectures of 50 minutes each and a 2.5 hour lab.
3. **Instructor's or course coordinator's name:** Dr. Wenxin Liu
4. **Textbook, title, author and year:**
   - Stephen Chapman, *Electric Machinery and Power System Fundamentals*, 1st Edition, McGraw-Hill, 2001.
   - Stephen Chapman, *Electric Machinery Fundamentals*, 4th Edition, McGraw-Hill, 2003.
   - Fawwaz T. Ulaby & Michael M. Maharbiz, *Circuits*, 1st Edition, NTS Press, 2009.

   a. **Other supplemental materials:** Software: MatLab, MathCAD, PowerWorld
5. **Specific course information:**

   a. **Brief description of the content of the course (catalog description):** Introduction to the principles, concepts, and analysis of the major components of an electric power system, basic electromechanics, energy conversion and source conversion, transformers, transmission lines, rectifiers, regulators, and system analysis.

   b. **Prerequisite:** C or better in EE 280.

   c. **Indicate whether a required or elective course:** This is course is a possible elective Fore Engineering Physics students with the Electrical concentration.
6. **Specific goals for the course:**

   a. **specific course objectives:**
      - Solve single-phase and three-phase ac circuits problems, compute complex power and power factor, and make power and energy measurements
      - Understand operation of conventional and renewable sources of generation
      - Analyze and safely operate generators, transformers, and other electric machinery
      - Develop and solve mathematical models using linear algebra and iterative techniques for linear and nonlinear problems
      - Analyze power system using state of the art simulation software

   b. **explicitly indicate which of the program outcomes are addressed by the course:**
      - Applying knowledge of mathematics (including probability and statistics, differential and integral calculus, differential equations, linear algebra, and complex variables); science (chemistry, physics, and computer science); and engineering to the design and/or analysis of analog and digital circuits, signals and systems, electromagnetics, and electric power systems - ABET outcome: 3(a)
      - Designing and conducting experiments to simulate, test, validate, and/or verify - ABET outcome: 3(b)
      - Designing a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability - ABET outcome: 3(c)
      - Functioning effectively on teams - ABET outcome: 3(d)
      - An understanding of professional and ethical responsibility - ABET outcome: 3(f)

- Communicating effectively - ABET outcome: 3(g)
- Maintaining a knowledge of contemporary professional, societal and global issues - ABET outcome: 3(j)
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice - ABET outcome: 3(k)

7. **Brief list of topics to be covered:**
   - Single-phase AC circuits
   - Three-phase AC circuits
   - Magnetostatics
   - Transformers
   - Per unit system
   - Synchronous generators
   - Transmission lines
   - Power flow studies
   - Induction motors
   - Power conversion
   - Power converters
   - Laboratory topics will cover computation (MathCAD, MatLab, and PowerWorld) and machine (measurements, magnetic and inductors, power electronics, transformers, field trip, synchronous machines, power system operation)

1. Course number and name: E E 418 Capstone Design I

2. Credits and contact hours: 3 credits. Each week has one lecture of 150 minutes. Teams meet with Faculty Mentor and Capstone Coordinator outside of class.

3. Instructor's or course coordinator's name: Robert Hull

4. Textbook, title, author and year: N/A

a. Other supplemental materials: Lecture notes and presentation slides. Library of materials on class web site: learn.nmsu.edu

5. Specific course information:

a. Brief description of the content of the course (catalog description): Application of engineering principles to a significant design project. Includes teamwork, written and oral communication, and realistic technical, economic, and public safety requirements. Consent of instructor required.

b. Prerequisites or co-requisities: Prerequisite(s): C or better in E E 260, E E 314, E E 351, E E 380, and E E 391. Pre/Corequisite(s): E E 461. Senior standing.

c. Indicate whether a required or elective course: This course is required for Engineering Physics students with the Electrical concentration. However, it can be substituted by PHYS 450 – Capstone I, if the project is in electrical-engineering type in nature.

6. Specific goals for the course:

a. specific course objectives:

- To be able to determine performance requirements for a design.
- To design a system to meet constraints imposed by safety, materials, and related factors.
- To document the design process and communicate the design process both orally and written.
- To appropriately delegate and integrate individual team member tasks.

b. explicitly indicate which of the program outcomes are addressed by the course:

- Designing a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability - ABET outcome 3(c)
- Functioning effectively on teams – ABET outcome 3 (d)
- Identifying, formulating, and solving engineering problems -ABET outcome 3(e)
- Communicating effectively - ABET outcome 3(g)
- Understanding the impact of engineering solutions in a global, economic, environmental, and societal context - ABET outcome 3(h)
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice - ABET outcome: 3(k)

7. Brief list of topics to be covered: Topics vary by project but are meant to be a comprehensive summary and application of the EE curriculum as applied to a senior design project.

1. Course number and name: E E 419 Capstone Design II

2. Credits and contact hours: 3 credits. Each week has one lecture of 150 minutes. Teams meet with Faculty Mentor and Capstone Coordinator outside of class.

3. Instructor's or course coordinator's name: Robert Hull

4. Textbook, title, author and year: N/A

a. Other supplemental materials: Lecture notes and presentation slides. Library of materials on class web site: learn.nmsu.edu

5. Specific course information:

a. Brief description of the content of the course (catalog description): Realization of design project from E E 418 within time and budget constraints.

b. Prerequisites or co-requisities: Prerequisite(s): Prerequisite(s): (C or better in E E 260, E E 314, E E 351, E E 380, and E E 391) OR (C or better in E E 418). Pre/Corequisite(s): E E 461. Senior standing.

c. Indicate whether a required or elective course: This course is required for Engineering Physics students with the Electrical concentration. However, it can be substituted by PHYS 450 – Capstone II, if the project is in electrical-engineering type in nature.

6. Specific goals for the course:

a. specific course objectives:

- To build and test a design to validate established requirements and constraints.
- To make the design interface properly with other hardware and software entities.
- To document the test process and communicate the testing processes both orally and in writing.
- To appropriately delegate and integrate individual team member tasks.

b. explicitly indicate which of the program outcomes are addressed by the course:

- Designing and conducting experiments to simulate, test, validate, and/or verify - ABET outcome 3(b)
- Designing a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability - ABET outcome 3(c)
- Functioning effectively on teams – ABET outcome 3 (d)
- Communicating effectively - ABET outcome 3(g)

7. Brief list of topics to be covered: Topics vary by project but are meant to be a comprehensive summary and application of the EE or EP-EE curriculum as applied to a senior design project.

1. **Course number and name:** EE 425, Introduction to Semiconductor Devices
2. **Credits and contact hours:** 3 credits. Each week has two lectures of 75 minutes each.
3. **Instructor's or course coordinator's name:** Dr. Sang-Yeon Cho
4. **Textbook, title, author and year:** Ben G. Streetman and S. K. Banerjee, *Solid State Electronic Devices*, Prentice Hall (6th Edition), 2006.
   a. other supplemental materials:
   S. M. Sze and Kwok K. Ng, *Physics of Semiconductor Devices*, John Wiley & Sons, 2007.
   Robert F. Pierret, *Advanced Semiconductor Fundamentals*, Addison-Wesley, 1987.
   P. Bhattacharya, *Semiconductor Optoelectronic Devices*, Prentice Hall, 1997.
5. **Specific course information:**
   a. **Brief description of the content of the course (catalog description):** Energy bands, carriers in semiconductors, junctions, transistors, and optoelectronic devices, including light-emitting diodes, laser diodes, photodetectors, and solar cells.
   b. **Prerequisites:** C or better in EE 380 and EE 351.
   c. **Indicate whether a required, elective course:** This is an elective class for Engineering Physics students with the Electrical concentration.
6. **Specific goals for the course:**
   a. **Specific course objectives:**
      - Understanding of conduction and valence energy bands and bandgaps.
      - Determining carrier concentrations, drift and diffusion currents.
      - Determining the energy band diagram, current flow, capacitance of a p-n diode under different bias conditions, and heterojunctions.
      - Understanding of MOS C-V behavior, threshold voltage, MOSFET band diagrams, effective channel mobility, and body effect.
      - Understanding of optoelectronic devices (PDs, LEDs, and LDs).

   b. Explicitly indicate which of the program outcomes are addressed by the course:
   Applying knowledge of mathematics, science and engineering to the design and/or analysis of analog and digital circuits and other systems - ABET outcome: 3(a)
   An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice - ABET outcome: 3(k)
7. **Brief list of topics to be covered:**
   - Semiconductor materials; Crystal lattices; The Bohr Model
   - Quantum Mechanics: Potential wells, Kronig-Penny Model
   - Charge carriers in semiconductors: Fermi level, Diffusion, Drift, The Hall effect
   - Excess carriers: Carrier lifetime and photoconductivity, The Haynes-Shockley experiment
   - PN Junctions: Equilibrium conductions, forward- and reverse-biased junctions, parasitic capacitances, metal-semiconductor junctions, heterojunction
   - Field-effect transistors: The junction FET, The MS FET, The MIS FET, The MOS FET
   - Bipolar junction transistors: Carrier distributions and terminal currents in BJTs, Biasing
   - Optoelectronic Devices: Photodiodes, LEDs, and LDs.

1. **Course number and name:** EE 431 Power Systems II
2. **Credits and contact hours:** 3 credits. Each week has three lectures of 50 minutes each.
3. **Instructor's or course coordinator's name:** Dr. Sukumar Brahma

4. Textbook, title, author and year: Glover, Sarma, and Overbye, *Power System Analysis and Design*, Thomson, 4th Edition.

a. Other supplemental materials: Software: Matlab 7.5 or higher, Powerworld (comes with the book).

5. Specific course information:

a. brief description of the content of the course (catalog description): Analysis of a power system in the steady-state. Includes the development of models and analysis procedures for major power system components and for power networks.

b. prerequisites or co-requisities: Prerequisites: C or better in EE 391.

c. indicate whether a required or elective course: This is a possible elective for Engineering Physics students with the Electrical concentration.

6. Specific goals for the course:

a. specific course objectives:

- Ability to calculate power system parameters in per unit format, and to analyze power systems using this format.
- Ability to formulate and solve Power Flow problem to calculate the state of power systems.
- Ability to calculate parameters of transmission lines, given line configuration and conductor
- data.
- Ability to calculate performance of transmission line.

b. explicitly indicate which of the program outcomes are addressed by the course:

- Applying knowledge of mathematics (including probability and statistics, differential and integral calculus, differential equations, linear algebra, and complex variables); science (chemistry, physics, and computer science); and engineering to the design and/or analysis of analog and digital circuits, signals and systems, electromagnetics, and electric power systems - ABET outcome: 3(a)
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice - ABET outcome: 3(k)

7. Brief list of topics to be covered:

- Review of three-phase ac circuits, power factor
- Three-Phase Power Transformers
- Per Unit System
- Transmission line parameters
- Transmission line modeling and operation
- Analysis of power system in healthy state: Power Flow
- Analysis of power system in healthy state: Economic Dispatch

1. **Course number and name:** EE 473 Introduction to Optics *(cross-listed with PHYS 473)*
2. **Credits and contact hours:** 3 credits. Each week has three lectures of 50 minutes.
3. **Instructor's or course coordinator's name:** Dr. Michael D. DeAntonio
4. **Textbook, title, author and year:** Hecht, *Optics*, 4th Edition, Addison Wesley, 2001.
5. **Specific course information:**
   a. **Brief description of the content of the course (catalog description):** The nature of light, geometrical optics, basic optical instruments, wave optics, aberrations, polarization, and diffraction. Elements of optical radiometry, lasers and fiber optics.
   b. **Prerequisites or co-requisities:** PHYS 216 or 217.
   c. **Indicate whether a required or elective course:** This is an elective class for Engineering Physics students with the Electrical concentration.
6. **Specific goals for the course:**
   a. **specific course objectives:**
      - Describe general waves and wave motion including harmonic waves, plane waves, cylindrical waves and spherical waves. Use Maxwell's laws of electromagnetism and calculate the energy, momentum and Poynting vector for electromagnetic waves.
      - Describe the dipole source of waves including basic radiation theory and polarization, and the effect of waves on dielectric by the use of simple forcing functions.
      - Predict the final color of light when two colors are mixed in emitting sources, after reflection and after transmitting through color filters.
      - Calculate the angles and intensity of light after single or multiple reflection or refraction and the effect of multiple mirrors and lenses and apertures in a complex optical system.
      - Find the entrance and exit pupil in a complex optical system. Perform ray traces for complex optical systems graphically. Describe various types of aberration and their effect on the focus of an optical system.
      - Discuss and identify various types of polarization using the Mueller matrix and Stoke's parameters, and calculate the intensity of light when two or more waves interfere with one another.
      - Describe and predict the effects of interference between two beams of light directed at various angles, and the basics of advanced optical theory including nonlinear optics, Fourier optics, material optics, fiber optics and quantum optics.

   b. **explicitly indicate which of the program outcomes are addressed by the course:**
   - Applying knowledge of mathematics (including probability and statistics, differential and integral calculus, differential equations, linear algebra, and complex variables); science (chemistry, physics, and computer science); and engineering to the design and/or analysis of analog and digital circuits, signals and systems, electromagnetics, and electric power systems - ABET outcome: 3(a)
   - Designing a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability - ABET outcome: 3(c)

- Identifying, formulating, and solving engineering problems - ABET outcomes: 3(e)
- Maintaining a knowledge of contemporary professional, societal and global issues - ABET outcome: 3(j)
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice - ABET outcome: 3(k)

7. **Brief list of topics to be covered:**
   - Wave Motion
   - Electromagnetic Theory, Photons and Light
   - Geometrical Optics
   - Polarization
   - The Superposition of Waves
   - Interference
   - Advanced Optics

1. **Course number and name:** EE 478 Optical Sources, Detectors and Radiometry
2. **Credits and contact hours:** 4 credits (3+3P). Each week has three lectures of 50 minutes each and a 2.5 hour lab.
3. **Instructor's or course coordinator's name:** Dr. David G. Voelz
4. **Textbook, title, author and year:** *Infrared Detectors and Systems*, by Dereniak and Boreman, Wiley-Interscience, 1996.
   a. **Other supplemental materials:** Instructor notes on radiometry and ray tracing. Access to technical computer software such as MATLAB, MathCAD or IDL is recommended for design calculations.
5. **Specific course information:**
   a. **Brief description of the content of the course (catalog description):** Fundamentals of optical sources, detectors and radiometric measurements in the visible and infrared. Radiometry of imaging and nonimaging sensor systems.
   b. **Prerequisites or co-requisities:** PHYS 217.
   c. **Indicate whether a required or elective course:** This is a possible elective for Engineering Physics students with the Electrical concentration.
6. **Specific goals for the course:**
   a. **specific course objectives:**
      - Calculate irradiance and flux at a receiver for a given source radiance or exitance and geometrical arrangement.
      - Determine the stops, pupils and windows of an optical system using ray tracing methods and apply these results to determine the flux collected by the system.
      - Describe exitance and spectral characteristics of natural and artificial sources.
      - Describe different types of optical detection materials; their limitations and application in an optical detector. Design a transimpedance amplifier for a photodiode detector.
      - Use figures of merit, including signal-to-noise ratio, noise equivalent power, and detectivity, to compare detector performance. Calculate the end-to-end radiometric signal-to-noise ratio for an optical system application.
   b. **explicitly indicate which of the program outcomes are addressed by the course:**
      - Applying knowledge of mathematics (including probability and statistics, differential and integral calculus, differential equations, linear algebra, and complex variables); science (chemistry, physics, and computer science); and engineering to the design and/or analysis of analog and digital circuits, signals and systems, electromagnetics, and electric power systems - ABET outcome: 3(a)
      - Designing and conducting experiments to simulate, test, validate, and/or verify - ABET outcome: 3(b)
      - Identifying, formulating, and solving engineering problems - ABET outcome: 3(e)
      - An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice - ABET outcome: 3(k)

7. **Brief list of topics to be covered:**
- Radiometric and photometric quantities
- Lambertian source
- Radiometric calculations for imaging and non imaging systems
- Optical system stops, pupils and windows
- Paraxial ray tracing of an optical system
- Natural and artificial optical sources
- Blackbody and graybody radiation
- Temperature estimation from IR measurements
- Optical detector materials and sensing modes
- Photodiode detectors: electrical characteristics and transimpedance amplifiers
- Responsivity, noise equivalent power, detectivity
- Detector circuit frequency response
- System signal-to-noise
- Laboratory topics will cover: radiometric measurements without optical systems, radiometric measurements using optical systems, blackbody radiation and detector responsivity, electrical characteristics of photodiode detectors, noise & performance measurements of detection systems, final lab project

1. **Course number and name:** EE 486 Digital VLSI Design
2. **Credits and contact hours:** 3 credits (3). Each week has three lectures of 50 minutes each.
3. **Instructor's or course coordinator's name:** Dr. Paul M. Furth
4. **Textbook, title, author and year:** N. Weste and D.M. Harris, *Principles of CMOS VLSI Design: A Circuits and Systems Perspective*, 4th Ed., Addison-Wesley, 2011.
   a. **Other supplemental materials:**
   R. J. Baker, *CMOS Circuit Design, Layout, and Simulation*, 3rd Ed., John Wiley & Sons, 2010.
   Software: LTSpice, http://www.linear.com/designtools/software/#LTspice
5. **Specific course information:**
   a. **Brief description of the content of the course (catalog description):** An introduction to VLSI layers. Static and dynamic logic design, memory circuits, arithmetic operators, and digital phase-locked loops.
   b. **Prerequisites or co-requisities:** C or better in EE 380 and EE 260.
   c. **Indicate whether a required or elective course:** This is a possible elective for Engineering Physics students with the Electrical concentration.
6. **Specific goals for the course:**
   a. **specific course objectives:**
   - Describe CMOS process and draw layouts.
   - Analyze and design CMOS inverters/buffers, static logic gates, dynamic logic gates, transmission gates, and flip-flops.
   - Analyze and design arithmetic operators – adders, multipliers, and encoders/decoders.
   - Analyze and design special-purpose digital circuits, including static and dynamic RAM and digital phase-locked loops.
   - Enter schematics and simulate circuits using LT-Spice.
   - Understand professional and ethical responsibility.
   - Understand the impact of engineering solutions.
   - Maintain a knowledge of contemporary issues.

   b. **explicitly indicate which of the program outcomes are addressed by the course:**
   - Applying knowledge of mathematics (including probability and statistics, differential and integral calculus, differential equations, linear algebra, and complex variables); science (chemistry, physics, and computer science); and engineering to the design and/or analysis of analog and digital circuits, signals and systems, electromagnetics, and electric power systems - ABET outcome: 3(a)
   - Designing a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability - ABET outcome: 3(c)
   - An understanding of professional and ethical responsibility - ABET outcome: 3(f)
   - Understanding the impact of engineering solutions in a global, economic, environmental, and societal context - ABET outcome: 3(h)
   - Maintaining a knowledge of contemporary professional, societal and global issues - ABET outcome: 3(j)

- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice - ABET outcome: 3(k)

7. **Brief list of topics to be covered:**
   - Introduction, Fabrication Process, and Cross Sectional Views
   - CMOS Design, Pass Transistors, Transmission Gates, and Stick Diagrams
   - MOS Transistor Theory (Ideal Characteristics, Gate Capacitance)
   - Non Ideal Transistor Theory (Leakage, Body effect)
   - Introduction to SPICE
   - DC and Transient Response
   - Logical Effort of Paths, Delay in Logic, Multi-Stage Logic Networks
   - Combinational Circuits
   - Circuit Families
   - Latches and Flip Flops
   - Dynamic and Static Power Dissipation
   - Adder Circuits
   - Data-path Functional Units
   - Memory Arrays, Static RAM
   - Phase-Locked Loops and Delay-Locked Loops
   - Wires and Interconnect

Mechanical Engineering Courses

Course Information	**ME 102 Mechanical Engineering Orientation** 1 credits Required Spring 2012
INSTRUCTOR:	Robert Nichols Phone: 527-7610 email: nicholsr@nmsu.edu
ASSISTANTS:	NA
OFFICE HOURS:	by email
CATALOG DESCRIPTION:	Emphasis on tours of M E labs and NMSU facilities that illustrate possible career paths for mechanical engineers. Students are introduced to department faculty, student organizations, and support services at NMSU. Topics include role of good communication skills, using modern technology, team building, and intellectual property. Students are advised in planning balance of their academic program. Restricted to majors.
PREREQUISITES:	None
TEXT:	*None*
CLASS SCHEDULE:	Lecture: 11:45 a.m. - 12:35 p.m. - R - JH 209
GRADES:	Attendance 50% Projects & report 50%
COURSE OBJECTIVES:	• Introduce students to the NMSU Mechanical & Aerospace Engineering College, Including Faculty and Staff • Expose students to a career and learning opportunities in mechanical engineering. • Teach the student individually learn on their own if required to obtain an answer. • Provide students exposure to the basic principles with hands-on design and testing • Expose the student to a team environment to learn problem solving and find success as a team. • Try to give the student basic tools to help to be successful in future classes and life.
TOPICS COVERED:	• Practical rules for rounding and presentation of results • ME Faculty, Student Organizations, Available Resources • "What is a Mechanical Engineer", Dr. Floyd Adams • WSMR Shock & Vibration, Jeffery Dallman • Engineering Law, Ethics & Economics
RELATIONSHIP TO PROGRAM EDUCATIONAL OBJECTIVES:	B ability to formulate, analyze, and creatively participate in the solution of multidisciplinary problems through use of modern engineering 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

Course Information	**ME 102 Mechanical Engineering Orientation** 1 credits Required Spring 2012
	f understanding of professional and ethical responsibility
POLICIES:	**<u>Attendance</u>** • No more than 2 absences are permitted without affecting your grade. • Absences 1&2 will be -1 Pts each; 3&4: -2 Pts each; 5&6: -3 Pts each; 7 and above: 5 Pts each. • You are required to sign an attendance sheet for each class. **<u>Projects</u>** • At the least there will be a static data collection & calculation project worth 10 Pts. • A data system definition project worth 10 Pts. • A basic dynamics measurement calculation project worth 10 Pts. • An extended dynamic measurement calculation project worth 10Pts. • A Dynamic System definition extension project worth 10 Pts. • Late submission of a project may result in point reduction. **<u>Team & Individual Efforts</u>** • Students are encouraged to work in teams and to compare efforts & results. All reports however will be submitted by the individual students and must be the personal work of the student. Hardcopy reports are expected and quality of the report will be evaluated. Submissions via e-mail will not be accepted. • All reports become the sole property of the instructor and will not be returned. You should keep a copy. • If there are question about the data presented you may be asked to submit an electronic version of the report, data collected, calculated, or presented.
AUTHOR/DATE:	R. Nichols January 2012

Course Information	**ME 159 Graphical Communication and Design** 2 credits Required Spring 2012
INSTRUCTOR:	James Vennes Office: JH20 Phone: 646-3375 email: jvennes@nmsu.edu
ASSISTANTS:	TBA
OFFICE HOURS:	MWF or by appointment
CATALOG DESCRIPTION:	Sketching and orthographic projection. Covers detail and assembly working drawings, dimensioning, tolerance specification, and design projects.
PRE/COREQUISITES:	Math 190
TEXT:	*NX 7 for Designers, Sham Tickoo, CADCIM Technologies, 2009* This is a Blackboard course – Go to https://my.nmsu.edu - NMSU Bookmarks Blackboard OR use https://learn.nmsu.edu directly in the web browser.
CLASS SCHEDULE:	Lecture: 1:10 p.m. - 2:10 p.m. - T - JH 604 Section M01 Lab: 2:10 p.m. - 5:00 p.m. - T - JH 604 Lecture: 1:30 p.m. - 2:20 p.m. - W - JH 604 Section M02 Lab: 2:30 p.m. - 5:20 p.m. - W - JH 604 Lab Hours Outside of Class for Doing Homework: 8:00 a.m. – 5:00 p.m. - Jett Hall 21 5:00 p.m. – 10:00 p.m. - Jett Hall 604
GRADES:	Quizzes: 10% Final Project: 10% Labs/Homework: 20% (possible +8% 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. • The student will become familiar with computers from an historical, software, and

Course Information	**ME 159 Graphical Communication and Design** 2 credits Required Spring 2012
	hardware perspective as they are used in mechanical engineering. • 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:	Using Unigraphics NX • Feature-based solids modeling – creation of basic and intermediate features • NX as a design tool - building design intent into models • Assembly modeling • Creating engineering drawings of parts and assemblies Practices and Procedures Used to Produce Engineering Drawings • 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 EDUCATIONAL OBJECTIVES:	A mastery of the fundamentals of mechanical engineering B ability to formulate, analyze, and creatively participate in the solution of multidisciplinary problems through use of modern engineering
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 ABET SPECIFIC CRITERIA:	ME4 ability to work professionally in both thermal and mechanical systems areas
AUTHOR/DATE:	J. Vennes January 2012

Course Information	**ME 236 Engineering Mechanics I** 3 credits Required Spring 2012
INSTRUCTOR:	Dr. Ma'en Sari Office: JH513 Phone: 646-2630 email: maen@nmsu.edu
ASSISTANTS:	Diego Bezerra email: dbezerra@nmsu.edu
OFFICE HOURS:	1:00 p.m.- 3:00 p.m. TR 11:00 a.m.- 12:00 p.m. F or by appointment
CATALOG DESCRIPTION:	Force systems, resultants, equilibrium, distributed forces, area moments, friction, and kinematics of particles.
PREREQUISITES:	Math 192
PRE/COREQUISITES:	Phys 215
TEXT:	*Engineering Mechanics: Statics and Dynamics, 12th Ed., Russell C. Hibbeler, Pearson Education, ISBN-10: 0138149291, ISBN-13: 9780138149291.*
CLASS SCHEDULE:	Lecture: 8:30 a.m. - 9:20 a.m. - MWF - JH 204 Section M01 Lecture: 9:30 a.m. - 10:20 a.m. - MWF - JH 204 Section M02
GRADES:	Homework: 20% Exam 1 25% Exam 2 25% Final Exam 30%
COURSE OBJECTIVES:	After completing this course, a student should be able to: • Determine resultants of concurrent force systems using vector method (a). • Apply equilibrium conditions to force systems (a). • Construct free body diagrams of particles, rigid bodies, and structures, and identify all external forces and moments acting on them (k). • Use principles of equilibrium to determine forces and moments acting on individual members of trusses, and other structures (k). • Apply concepts of friction to a variety of problems including ramps, sliding vs. tipping, wedges, and belts (e). • Determine the centroid and moment of inertia of cross-sectional areas, including structural shapes (a).

Course Information	**ME 236 Engineering Mechanics I** 3 credits Required Spring 2012
TOPICS COVERED:	Statics and Particle Dynamics • Vectors • Particle equilibrium • Equivalent force systems • Rigid body equilibrium • Area and mass moments of inertia • Friction • Kinematics of particles
RELATIONSHIP TO PROGRAM EDUCATIONAL OBJECTIVES:	A mastery of the fundamentals of mechanical engineering B ability to formulate, analyze, and creatively participate in the solution of multidisciplinary problems through use of modern engineering
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:	ME2 ability to apply advanced mathematics, multivariate calculus, and differential equations
POLICIES:	• Homework assignments are due at the BEGINNING of class the day they are due. • No late homework will be accepted unless prior arrangements have been made with the instructor. • No make-up allowed on homework except by prior arrangement. **Class participation and behavior** • Classroom participation is a part of learning; it is only by asking questions and talking through ideas that you can come to fully understand the material. In calculating your final grade, I will take into consideration the contribution you have made to the discussion in class. • Please do not engage in behavior which detracts from the ability of other students to learn. Such behaviors include arriving at class late, speaking or whispering while the instructor and students are discussing ideas or asking questions, reading newspapers in class, cell-phones ringing, etc.
AUTHOR/DATE:	M. Sari January 2012

Course Information	**ME 237 Engineering Mechanics II** 3 credits Required Spring 2012
INSTRUCTOR:	Dr. J. Genin Office: JH110 Phone: 646-3809 email: jgenin@nmsu.edu
ASSISTANTS:	NA
OFFICE HOURS:	1:30 p.m.- 2:30 p.m. MTWRF 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
PRE/COREQUISITES:	Math 291
TEXT:	*Engineering Mechanics: Statics and Dynamics, 12th Ed., Russell C. Hibbeler, Pearson Education, ISBN-10: 0138149291, ISBN-13: 9780138149291.*
CLASS SCHEDULE:	Lecture: 10:30 a.m. - 11:20 a.m. - MWF - JH 209 M01 Lecture: 12:30 p.m. - 1:20 p.m. - MWF - JH 103 M02
GRADES:	Homework: 15% Test1: 15% Test2: 20% Test3: 25% Final Exam: 25%
COURSE OBJECTIVES:	After completing this course, a student should be able to: • Understanding of Static and Dynamic Equilibrium • Proficiency in developing Mathematical Models (FBD's) • Understanding of the Kinematics and Kinetics of Particles • Understanding of Energy and Momentum Principles wrt Particles • Understanding of the Kinematics and Kinetics for Planar Motion of Rigid Bodies • Understanding of Energy and Momentum Principles for Planar Motion of Rigid Bodies • Understanding of the Kinematics and Kinetics for Three Dimensional Motion of Rigid Bodies • The ability to use knowledge acquired in above to formulate, solve and interpret solutions

Course Information	**ME 236 Engineering Mechanics I** 3 credits Required Spring 2012
	of engineering problems.(e)
TOPICS COVERED:	• Vector Algebra and Static Equilibrium • Kinematics and Kinetics, Energy and Momentum principles for Particles Rigid Bodies in Planar Motion Rigid Bodies in Three Dimensional Motion • Moments and Products of Inertia • Relative Motion and Moving Reference Frame
RELATIONSHIP TO PROGRAM EDUCATIONAL OBJECTIVES:	B ability to formulate, analyze, and creatively participate in the solution of multidisciplinary problems through use of modern engineering
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, 5. results, and where appropriate, 6. analysis of 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. • Grades will be assigned on an absolute scale
AUTHOR/DATE:	J. Genin January 2012

Course Information	**ME 240 Thermodynamics** 3 credits Required Spring 2012
INSTRUCTOR:	Dr. Ian H Leslie Office: JH112 Phone: 646-2335 email: ileslie@nmsu.edu
ASSISTANTS:	Moises Gonzalez Reyes email: grmoises@nmsu.edu
OFFICE HOURS:	4:30 p.m.- 5:30 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, 7th ed., the McGraw-Hill Companies, Inc., New York, © 2008* This is a Blackboard course – http://learn.nmsu.edu to go to Blackboard page or the Blackboard link on MyNMSU page - https://my.nmsu.edu
CLASS SCHEDULE:	Lecture: 8:30 a.m. - 9:20 a.m. - MWF - JH 209 M01 Lecture: 10:30 a.m. – 11:20 a.m. - MWF - JH 209 M02
GRADES:	Homework & Quizzes 15% 3 class exams & Final Exam 85%
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.(a) • 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 Otto and Rankine cycles.(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

Course Information	**ME 240 Thermodynamics** 3 credits Required Spring 2012
	• Entropy and First and Second Law applications • Introduction to power cycles • Reviews and Exams
RELATIONSHIP TO PROGRAM EDUCATIONAL OBJECTIVES:	B ability to formulate, analyze, and creatively participate in the solution of multidisciplinary problems through use of modern engineering
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:	• None
AUTHOR/DATE:	I. Leslie January 2012

Course Information	**ME 261 Mechanical Engineering Problem Solving** 4 credits Required Spring 2012
INSTRUCTOR:	Dr. Gabe Garcia Office: JH206A Phone: 646-7749 email: gabegarc@nmsu.edu
ASSISTANTS:	Jose Garcia Office: JH606 Phone: 646-2713 email: ramgar01@nmsu.edu
OFFICE HOURS:	9:30 a.m.- 12:00 p.m. MWF 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:	*Applied Numerical Methods with MATLAB, 3rd Ed., Steven Chapra, McGraw-Hill, 2010*
CLASS SCHEDULE:	Lecture: TR 08:55 a.m. - 10:10 a.m. EC 110 Sections M01 & M70 Lab: R 2:35 p.m. - 5:25 p.m. JH 604 Section M01 Lab: R 5:30 p.m. - 8:20 p.m. JH 604 Section M70
GRADES:	Homework: 10% Lab Work: 10% Exam1: 20% Exam2: 20% Exam3: 20% Exam4: 20%
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)

Course Information	**ME 261 Mechanical Engineering Problem Solving** 4 credits Required Spring 2012
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
RELATIONSHIP TO PROGRAM EDUCATIONAL OBJECTIVES:	A mastery of the fundamentals of mechanical engineering
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:	PC2 1 year math and basic science 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 ME3 familiarity with statistics and linear algebra
POLICIES:	• All computer programs must be written in MATLAB as instructed and well commented. • All Homework must be uploaded into the appropriate folder on the M drive by 11:30 p.m. the day it is due. • Late homework or homework not in the correct folder will be assigned a zero grade. • All labs and exams must be uploaded into the appropriate folder on the M drive by the end of class on the day of the lab or exam. • 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. • Attendance will be checked each class period. Students who miss three consecutive class periods or continually miss class periods will be dropped from the course.
AUTHOR/DATE:	G. Garcia January 2012

Course Information	**ME 326 Mechanical Design** 3 credits Required Spring 2012
INSTRUCTOR:	Dr. Edgar Conley Office: JH519 Phone: 646-5698 email: econley@nmsu.edu
ASSISTANTS:	TBA
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, 4th Ed., Juvinal and Marshek, Wiley, 2006*
CLASS SCHEDULE:	Lecture: 11:30 a.m. - 12:20 p.m. - MW - JH 203 Lab: 12:30 p.m. - 1:20 p.m. - MWF - JH 203
GRADES:	Class participation: 5% Homework: 50% Design Project: 20% Final Exam: 25%
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:	• Design Methods • Case studies • Professional practice • Safety
RELATIONSHIP TO PROGRAM EDUCATIONAL OBJECTIVES:	B ability to formulate, analyze, and creatively participate in the solution of multidisciplinary problems through use of modern engineering D skills needed to fulfill professional duties and responsibilities in teamwork, collegiality, ethics, technical leadership, etc.

Course Information	**ME 326 Mechanical Design** 3 credits Required Spring 2012
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
CONTRIBUTION TO PROFESSIONAL COMPONENT:	PC1 major design experience 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:	• No makeup exam • Late homework will not be accepted. • Grades will be normalized. Then, 90=a, 80=b, 70=c, etc.
AUTHOR/DATE:	E. Conley January 2012

Course Information	**ME 328 Engineering Analysis I** 3 credits Required Spring 2012
INSTRUCTOR:	Nathanael Greene Office: JH 628 Phone: 646-3322 email: ngreene@nmsu.edu
ASSISTANTS:	NA
OFFICE HOURS:	6:00 p.m.- 7:00 p.m. M or by appointment
CATALOG DESCRIPTION:	Mathematical methods for exact and approximate solutions of engineering problems.
PREREQUISITES:	Math 392
TEXT:	*Advanced Engineering Mathematics, 2nd Ed., Michael D. Greenberg, Prentice-Hall, 1998 -* (There will also be handouts from time to time.)
CLASS SCHEDULE:	Lecture: 7:30 a.m. - 8:45 a.m. - TR - JH 203
GRADES:	Exam 1: 25% Exam 2: 25% Portfolio: 25% Homework: 25%
COURSE OBJECTIVES:	• To learn how to construct differential equation models of phenomena relevant to Mechanical & Aerospace engineering. (a) • To learn basic methods for solution of these ordinary and partial differential equations. • To apply the solutions to simple analysis and design situations. (e)
TOPICS COVERED:	• Ordinary Differential Equations • Laplace Transforms • Linear Algebra • Fourier Series and Fourier Transforms • Partial Differential Equations
RELATIONSHIP TO PROGRAM EDUCATIONAL OBJECTIVES:	A mastery of the fundamentals of mechanical engineering
RELATIONSHIP TO PROGRAM OUTCOMES:	a ability to apply knowledge of mathematics, science, and engineering

Course Information	**ME 328 Engineering Analysis I** 3 credits Required Spring 2012
CONTRIBUTION TO PROFESSIONAL COMPONENT:	PC2 1 year math and basic science
RELATIONSHIP TO ABET SPECIFIC CRITERIA:	ME2 ability to apply advanced mathematics, multivariate calculus, and differential equations ME3 familiarity with statistics and linear algebra
POLICIES:	• Grading will be on a curve; grades will be determined based on comparison of each student's total with the overall class average. • Collaboration with other students in attacking homework problems is permitted, but the assignments turned in should be the student's own work. • One day late homework will lose 25% value and later homework will not be accepted.
AUTHOR/DATE:	N. Greene January 2012

Course Information	**ME 329 Engineering Analysis II** 3 credits Required Spring 2011
INSTRUCTOR:	Dr. Ian Leslie Office: JH112 Phone: 646-2335 email: ileslie@nmsu.edu
ASSISTANTS:	NA
OFFICE HOURS:	9:30 a.m.- 12:00 p.m. MWF or by appointment
CATALOG DESCRIPTION:	Numerical methods for roots of linear and nonlinear equations, numerical integration, and solution of ordinary differential equations with emphasis on software design and engineering applications.
PREREQUISITES:	Math 392, ME 260
TEXT:	*No text*
CLASS SCHEDULE:	Lecture: 1:10 p.m. - 2:15 p.m. - TR - JH 103
GRADES:	Homework 70% Quizzes 30%
COURSE OBJECTIVES:	• Students will learn a variety of numerical methods that are useful in both basic and advanced engineering calculations. (a, e) • Students will develop an appreciation for the hazards and limitations of numerical solutions, including accuracy, stability, and computer limitations of memory and speed. (e, k) • Students will learn the basics of Matlab. (k)
TOPICS COVERED:	• 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 • Solution of partial differential equations
RELATIONSHIP TO PROGRAM EDUCATIONAL OBJECTIVES:	A mastery of the fundamentals of mechanical engineering
RELATIONSHIP TO PROGRAM OUTCOMES:	a ability to apply knowledge of mathematics, science, and engineering k ability to use the techniques, skills and modern tools necessary for engineering practice

Course Information	**ME 329 Engineering Analysis II** 3 credits Required Spring 2011
CONTRIBUTION TO PROFESSIONAL COMPONENT:	PC2 1 year math and basic science
RELATIONSHIP TO ABET SPECIFIC CRITERIA:	ME2 ability to apply advanced mathematics, multivariate calculus, and differential equations ME3 familiarity with statistics and linear algebra
POLICIES:	• Homework assignments must be turned in on time for full credit. • Collaboration in the form of discussion of formulation of solutions or results is encouraged for homework; however, each individual must work independently to create the final homework solution. • Collaboration in any form is not allowed for the quizzes. • Grades may be curved but the instructor makes no commitment to do so.
AUTHOR/DATE:	I. Leslie January 2011

Course Information	**ME 331 Intermediate Strength of Materials** 3 credits Spring 2012
INSTRUCTOR:	Dr. Vincent Choo Office: JH516 Phone: 646-2225 email: vchoo@nmsu.edu
ASSISTANTS:	NA
OFFICE HOURS:	via email
CATALOG DESCRIPTION:	Covers stress and strain, theories of failure, curved flexural members, flat plates, pressure vessels, buckling, and composites.
PREREQUISITES:	Math 392, CE 301
TEXT:	*Advanced Strength and Applied Stress Analysis, 2nd Ed., Richard G. Budynas, McGraw-Hill, 1999*
CLASS SCHEDULE:	Lecture: 11:30 a.m. - 12:20 a.m. - MWF - JH 204
GRADES:	Homework: 20% Quizzes: 20% Mid-term Exam: 30% Final Exam: 30%
COURSE OBJECTIVES:	• This course is designed to develop the student's ability to solve strength of materials problems.
TOPICS COVERED:	• Stress • Equilibrium Equation • Stress Transformation • Strain • Compatibility Condition • Strain Transformation • Constitutive relation • Plane Elastic Problems • The Airy Stress Function • Bending of thin flat plates • Thick-wall pressure vessels • Virtual Load Method - Statically Indeterminate Problems • Rayleigh Method • Rayleigh – Ritz Method • Photoelasticity • Matrices

Course Information	ME 331 Intermediate Strength of Materials 3 credits Spring 2012
POLICIES:	• Attend all lectures
AUTHOR/DATE:	V. Choo January 2012

Course Information	**ME 333 Intermediate Dynamics** 3 credits Spring 2012
INSTRUCTOR:	Dr. Joe Genin Office: JH 110 Phone: 646-3809 email: jgenin@nmsu.edu
ASSISTANTS:	NA
OFFICE HOURS:	MWF 1-2pm, or by appointment
CATALOG DESCRIPTION:	Three dimensional kinematics and kinetics, orbital motion, Lagrange's equations, dynamic stability, and controls.
PREREQUISITES:	ME 237 or consent of instructor
TEXT:	*Website – http://me.nmsu.eud/~jgeninn*
CLASS SCHEDULE:	Lecture: 11:30 a.m. - 12:20 a.m. - MWF - JH 204
GRADES:	Homework: 40% # Tests: 60%
COURSE OBJECTIVES:	• Understanding of Kinematics of Rigid Bodies • Understanding of Dynamic Equilibrium of Rigid Bodies • Proficiency in developing Mathematical Models using a) free body diagrams, b) Lagrange's equations (c) • Ability to use knowledge acquired above to formulate and solve problems in intermediate dynamics
TOPICS COVERED:	• Kinematics and Kinetics of Particles and Planar Rigid Bodies using moving reference frames, featuring Cartesian Coordinates, Path Variables, Cylindrical Coordinates • Kinematics of three dimensional bodies • Kinetic descriptions considering: Equations of Motion, Work-Energy, • Linear Impulse-Momentum, Angular Impulse-Momentum • Mass Moments and Products of Inertia • Langrange's Equations • Dynamic Stability • Nonholonomic Systems • Vibrations, Single degree of freedom Free, Forced, Damped • Vibrations, Multi-degrees of freedom Free, Forced, Damped
AUTHOR/DATE:	J. Genin

Course Information	**ME 338 Fluid Mechanics** 3 credits Required Spring 2012
INSTRUCTOR:	Dr. B. Shashikanth Office: JH 611 Phone: 646-4348 email: shashi@nmsu.edu
ASSISTANTS:	NA
OFFICE HOURS:	1:30 p.m.- 3:30 p.m. MW 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:	ME 237
PRE/COREQUISITES:	CE 301 and ME 328
TEXT:	*Fundamentals of Fluid Dynamics, B.R. Munson, D.F. Young and T.H. Okiishi, Wiley, 6th edition (Student Value Edition), 2009*
CLASS SCHEDULE:	Lecture: 11:30 a.m. - 12:20 p.m. - TR - JH 205
GRADES:	Homework: 15% Four exams: 45% Class participation: 5% Final: 35%
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 EDUCATIONAL OBJECTIVES:	A mastery of the fundamentals of mechanical engineering B ability to formulate, analyze, and creatively participate in the solution of multidisciplinary problems through use of modern engineering
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)
RELATIONSHIP TO ABET SPECIFIC CRITERIA:	ME2 ability to apply advanced mathematics, multivariate calculus, and differential equations

Course Information	**ME 338 Fluid Mechanics** 3 credits Required Spring 2012
	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, four exams and a comprehensive final. Absence from graded classroom activities will result in a grade of zero on that exam, unless student informs instructor before the exam and produces a valid document of absence.
AUTHOR/DATE:	B. Shashikanth January 2012

Course Information	**ME 341 Heat Transfer** 3 credits Required Spring 2012
INSTRUCTOR:	Dr. Ma'en Sari Office: JH513 Phone: 646-2630 email: maen@nmsu.edu
ASSISTANTS:	NA
OFFICE HOURS:	1:00 p.m.- 3:00 p.m. TR 11:00 a.m.- 12:00 p.m. F or by appointment
CATALOG DESCRIPTION:	Fundamentals of conduction, convection, and radiation. Design of heat transfer systems.
PREREQUISITES:	ME 240, ME 328
TEXT:	*Principles of Heat Transfer, Kreith, Manglik, Bohn, 7th Edition, Cengage Learning, ISBN: 9780495667704*
CLASS SCHEDULE:	Lecture: 1:30 p.m. - 2:20 a.m. - MWF - JH 205
GRADES:	Homework and Quizzes 20% Exam 1 25% Exam 2 25% Final Exam 30%
COURSE OBJECTIVES:	• Students will learn to formulate and solve typical analytical problems that arise in Mechanical Engineering • Students will become familiar with special mathematical functions that arise in the solution of Mechanical Engineering problems
TOPICS COVERED:	• Steady-State Conduction • Transient Conduction • Internal Convection • External Convection • Free Convection • Boiling and Condensation • Heat Exchangers • Radiation Properties and Processes • Radiation Exchange Between Surfaces • Applications and Design

Course Information	**ME 341 Heat Transfer** 3 credits Required Spring 2012
RELATIONSHIP TO PROGRAM EDUCATIONAL OBJECTIVES:	A mastery of the fundamentals of mechanical engineering
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 ME4 ability to work professionally in both thermal and mechanical systems areas
POLICIES:	• During lecture, please turn off all cell phone ringers and pager buzzers so that these devices do not disturb the class (or the professor). **Class participation and behavior** • Classroom participation is a part of learning; it is only by asking questions and talking through ideas that you can come to fully understand the material. In calculating your final grade, I will take into consideration the contribution you have made to the discussion in class. • Please do not engage in behavior which detracts from the ability of other students to learn. Such behaviors include arriving at class late, speaking or whispering while the instructor and students are discussing ideas or asking questions, reading newspapers in class, cell-phones ringing, etc.
AUTHOR/DATE:	M. Sari January 2012

Course Information	**ME 425 Design of Machine Elements** 3 credits Required Spring 2012
INSTRUCTOR:	Dr. Edgar Conley Office: JH519 Phone: 646-5698 email: econley@nmsu.edu
ASSISTANTS:	NA
OFFICE HOURS:	2:30 p.m.- 3:30 p.m. MWF 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: 25% Quizzes: 25% Project: 25% Final Exam: 25%
COURSE OBJECTIVES:	• Perform load analyses on machine element parts and assemblies. (a) • Perform stress and strain analyses on machine elements and determine element deflections. (a,e,k) • Utilize standard failure theories and fatigue analysis to develop safety factors and reliability for machine elements. (f,i,k) • Select materials for particular machine elements and machine element assemblies. (e,i) • Design machine elements and machine element assemblies. (c,k) • Work effectively as part of a design team. (c,g)
TOPICS COVERED:	• Load analysis • Materials • Stresses • Deflections • Failure theories and fatigue analysis • Bearings, gears, and shafts • Project
RELATIONSHIP TO PROGRAM	A mastery of the fundamentals of mechanical engineering

Course Information	**ME 425 Design of Machine Elements** 3 credits Required Spring 2012
EDUCATIONAL OBJECTIVES:	B ability to formulate, analyze, and creatively participate in the solution of multidisciplinary problems through use of modern engineering
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
CONTRIBUTION TO PROFESSIONAL COMPONENT:	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:	• 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:	E. Conley January 2012

Course Information	**ME 426/427 Design Project Laboratory I & II** 6 credits Required Spring 2012
INSTRUCTOR:	Dr. Young H. Park Office: JH 615 Phone: 646-3092 email: ypark@nmsu.edu
ASSISTANTS:	TBD
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 - HA 104 3:30 p.m. - 6:20 p.m. - W - JH 283
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

Course Information	**ME 426/427 Design Project Laboratory I & II** 6 credits Required Spring 2012
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)
RELATIONSHIP TO ABET SPECIFIC CRITERIA:	ME4 ability to work professionally in both thermal and mechanical systems areas
POLICIES:	• None
AUTHOR/DATE:	Y. Park January 2012

Course Information	**ME 449 Mechanical Engineering Senior Seminar** 1 credits Required Spring 2012
INSTRUCTOR:	Dr. Edgar Conley Office: JH519 Phone: 646-5698 email: econley@nmsu.edu
ASSISTANTS:	NA
OFFICE HOURS:	2:30 p.m.- 3:30 p.m. TR or by appointment
CATALOG DESCRIPTION:	Senior seminar course covering topics relevant to graduating mechanical engineering seniors (job placement, interviewing techniques, resume preparation).
PREREQUISITES:	senior standing
TEXT:	*None; handouts will be provided as needed*
CLASS SCHEDULE:	Lecture: 11:30 a.m. - 12:20 p.m. - F - JH 203
GRADES:	Attendance: 50% Writing assignments: 50%
COURSE OBJECTIVES:	• to prepare students for productive and fulfilling careers in industry and/or graduate school • to provide guidance and instruction in ethics and professionalism (f) • to expose students to successful practicing engineers and others who can offer advice and counseling (k, i) • to improve written communication skills (g) • to promote lifelong learning and breadth in perspective (i)
TOPICS COVERED:	• Career paths • Reading and lifelong learning • Graduate school as a career option • Engineering ethics • Business comportment, etiquette, manners • Engineers and the environment • Professional registration and licensing
RELATIONSHIP TO PROGRAM 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.

Course Information	ME 449 Mechanical Engineering Senior Seminar 1 credits Required Spring 2012
RELATIONSHIP TO PROGRAM OUTCOMES:	f understanding of professional and ethical responsibility g ability to communicate effectively i recognition of the need for, and an ability to engage in lifelong learning j knowledge of contemporary issues
CONTRIBUTION TO PROFESSIONAL COMPONENT:	NA
RELATIONSHIP TO ABET SPECIFIC CRITERIA:	NA
POLICIES:	• attendance will be monitored
AUTHOR/DATE:	E. Conley January 2012

Course Information	**ME 445 Experimental Methods II** 3 credits Required Spring 2012
INSTRUCTOR:	Dr. A. Donaldson Office: JH612 Phone: 646-6545 email: bdonalds@nmsu.edu
ASSISTANTS:	Ahmed Showman, Mohammad Omari, Mehdi Tabandeh
OFFICE HOURS:	After lecture or by appointment
CATALOG DESCRIPTION:	Emphasis on experimental techniques, instrumentation and data acquisition in fluid mechanics, heat transfer, and thermodynamics. Laboratory results will be presented in written and verbal formats.
PREREQUISITES:	(ME 338 or AE 339), ME 340, ME 341, and ME 345
TEXT:	*Experimental Methods for Engineers 7th, Holman, J. P., McGraw-Hill, Inc., 2001* (optional). In addition, textbooks utilized in the theory courses for thermodynamics, fluid mechanics and heat transfer (corresponding to prerequisites listed above) will be utilized as references. ME 445 Course Notes as available from MAE M-drive.
CLASS SCHEDULE:	Lecture: 1:30 p.m. - 2:20 p.m. - WF - JH 103 Lab: See Course Schedule - TBA
GRADES:	Formal reports and prelabs: 50% Final report, including proposal and oral presentation: 30% Scheduled quizzes (3) and unscheduled classroom exercises: 20%
COURSE OBJECTIVES:	• Physical demonstration of phenomenologies in fluid mechanics, heat transfer and thermodynamics • Provide students with opportunities to predict outcomes of experiments based on theoretical models and verify predictions by measurement • Utilize various measurement and data acquisition tools • Analyze data and present results • Participate as a team member of a functional group • Practice communication skills in both written and oral format
TOPICS COVERED:	• Pressure drop for liquid flow in straight pipe and fittings, comparison of flow meters, calibration of transducers, uncertainty analysis of orifice measurement. • Operation of a diesel engine on diesel fuels and vegetable oils and compare performance and emissions. • Pressure vessel blowdown modeling and measurement, writing applications for LabVIEW® based computer data acquisition.

Course Information	**ME 445 Experimental Methods II** 3 credits Required Spring 2012
	• Thermoelectric effect, including thermocouples, response time analysis, thermopiles. • Heat exchanger analysis and measurements for 3 types of heat exchangers. • Group directed experiment that will be proposed, planned and executed by group. Should include clear objectives, a theoretical model, data acquisition consistent with equipment which is available, and comparison to literature results. Concurrence of course instructor and TA on topic, methods and scope is required.
RELATIONSHIP TO PROGRAM EDUCATIONAL OBJECTIVES:	A mastery of the fundamentals of mechanical engineering 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
RELATIONSHIP TO PROGRAM OUTCOMES:	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:	ME2 ability to apply advanced mathematics, multivariate calculus, and differential equations ME3 familiarity with statistics and linear algebra ME4 ability to work professionally in both thermal and mechanical systems areas
POLICIES:	• Five of the experiments will be conducted on a two week cycle. The first week will be spent in analyzing the assigned problem and predicting outcome or collecting information which will be used later. When appropriate, the prediction will be submitted to the TA at the end of that session as a prelab, to document predictions over range of variables. Prelabs will also contain other requested information that will ultimately be included in the formal report. The second week will be devoted to experimentation and data collection. An electronic report will then be written and submitted at the start of the subsequent lab meeting. Late reports will carry a penalty of two points for each day late, unless a due date holiday is declared by course instructor. The report will discuss the theory and compare predictions to measurements and comment on quality of the comparison. The final topic will be a group selected experiment to make measurements to verify a hypothesis or determine a physical outcome, related to fluid mechanics, heat transfer or thermodynamics. The group will be responsible for writing a proposal including the objective(s), the theory that is to be utilized, the equipment required, the scope of the measurements, and the methodology. Once this proposal has been reviewed and approved by the course instructor and TA, the team will set about to assemble or fabricate the apparatus, make the measurement(s) and compare results to predictions or literature sources. This final report will be in both oral and written format.

Course Information	**ME 445 Experimental Methods II** 3 credits Required Spring 2012
	• This course seeks to prepare engineers for collaborative interaction with colleagues on a professional level. To that end, teams will be formed based on individual selection and each member is expected to participate in group activities related to pre-laboratory exercises, conduct of experiments and the reporting of results. After each report is submitted, the team can, by majority vote, elect to disband and reform in an altered configuration. Individuals who have been ejected from the group will prepare individual pre-lab predictions and subsequent reports, based on commonly collected and shared data. It is strongly advised that each individual in every group adequately contribute to the report preparation effort in order to avoid expulsion from the group. It is also advised that for each experiment, a group leader should be selected who will assign individual responsibilities and see to the final compilation and consistent format of the report and to its submission in a timely manner. • Reports will be ranked from high to low. Rather than a letter or numerical grade, a rank designator will be used, based on two components: technical presentation and grammatical presentation where each component carries comparable weight. As a general guide for the letter or numerical grade corresponding to the order rank, the highest rank can be tentatively assigned a 95, and the lowest rank can be tentatively assigned a 75. Final grades are anticipated to be curved based on a class average of "B".
AUTHOR/DATE:	A. Donaldson January 2012

Other Courses

(Civil Engineering, Chemistry, Mathematics)

1. **CE 301 Mechanics of Materials**

2. **Credits & Contact Hours:** 3 credit hours, 9:30 – 10:20 am M/W/F

3. **Instructor's name:** Brad D. Weldon

4. **Textbook**

Mechanics of Materials, 3rd Edition, Roy R. Craig, Jr., 2011.

-

5. **Course Information**

a. **Course Description:** Mechanics of Materials. Basic concepts of solid mechanics and how they apply to engineering design and analysis and provide understanding of the behavior of various types of engineering materials under different types of loadings.

b. **Prerequisites:** CE 233

c. **Designation**: Required for Undergraduate Civil Engineering Program

6. **Course Goals**

a. **Outcomes of instruction:**

At the end of the course the student will be able to:

Calculate deformations, stresses, and strains of various types of members under loading

Calculate principal stresses and strains

Perform two-dimensional stress and strain transformation

Analyze statically indeterminate structures using the method of consistent deformations

Construct shear and moment diagrams for beam type structures

Calculate beam deflections and rotations using various methods

b. **Student Outcomes:**

Criterion 3 Outcomes:

- apply knowledge of mathematics, science, and engineering in solving structural engineering problems [a]
- design components in structural engineering systems to meet desired needs [c]

- apply critical thinking skills to identify, formulate, and solve structural engineering problems common in civil engineering [e]

7. Topics 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

Prepared by: Brad D. Weldon Date: 08/15/2011

Course and Course Number: Chemistry 111G – General Chemistry I; 4 credits (3+3P)

Course Instructors: William Quintana, Antonio Lara

Catalog Description: Descriptive and theoretical chemistry

Prerequisite: (1) Grade of C or better in MATH 120 or a MPE Score adequate to enroll in a mathematics course beyond MATH 120, and (2) one of the following: B or better in second semester high school chemistry course, or grade of at least C in CHEM 100, or an enhanced ACT score of at least 22.

Required Texts:

- *Principles of Chemistry, a Molecular Approach*, by Nivaldo J. Tro; Publisher: Pearson 2010.
- *CHEM 111-112 lab textbook*, 5th edition, published by Cengage Learning
- *Laboratory Notebook* (Hayden), McNeil Pub

Objectives: At the end of this course, it is expected that the student will be able to:

1. Demonstrate knowledge of basic chemical principles, including the following areas: structure of the atom and nature of electrons, nuclear chemistry, periodicity of atomic properties, ionic vs. covalent bonds and the compounds containing them, molecular structure, geometry, stoichiometry, solutions, types of reactions.
2. See the applicability of chemistry to common occurrences in daily life.
3. Analyze a problem and determine the appropriate mathematical manipulation required to solve it.
4. Tie together macroscopic phenomena with microscopic understanding.

Lab Sections: Lab is a co-requisite for all students except those repeating the course.

Means of assessment:
Half exam (6.8%), three hour exams and final exam (13.3% each): 60%; Attendance: 5%;; Quizzes, assignments, participation: 15%; Lab experiments: 20%

Content:
The course will cover the material of the first half of the textbook. Labs are as follows:
Experiment 1: Sig. Figs and Density
Experiment 2: Laboratory Techniques
Experiment 9: Light Emission: Characterization of Ions by Flame Tests
Experiment 3: The Periodic Table
Experiment.15: Physical Changes
Experiment.17: Qualitative Analysis of Cations
Experiment.14: Solid Substances: Classification Using Physical Properties
Experiment.8: Shapes of Molecules
Experiment.12: Energy Changes & Chemical Reactions
Experiment.7: Solubility Rules
Experiment.16: Chemical Changes
Experiment.6: Hardware Models: Stoichiometry, Limiting Reactant and Yield

Course and Course Number: Chemistry 112G – General Chemistry II; 4 credits (3+3P)

Course Instructor: Deanna (Dede) Dunlay

Catalog Description: Descriptive and theoretical chemistry

Prerequisite: grade D or better in CHEM 111G and be approved to take MATH 121 or 152

Required Texts:

- *Principles of Chemistry, a Molecular Approach*, by Nivaldo J. Tro; Publisher: Pearson 2010.
- *CHEM 111-112 lab textbook*, 6th edition, published by Cengage Learning
- *Laboratory Notebook* (Hayden), McNeil Pub

Objectives:
The Higher Education Department has identified several common core competencies which the student will achieve through this sequence of science courses (CHEM 111 and 112). The student will:

- describe the process of scientific inquiry
- solve problems scientifically
- communicate scientific information
- apply quantitative analysis to scientific problems
- apply scientific thinking to real world problems

In CHEM 112G, these objectives will be realized by stressing the applications of chemistry to the real world in the areas of solutions, thermodynamics, chemical equilibrium (including acids/bases and solubility) and electrochemistry. This will be achieved through traditional assessments such as homework, quizzes and exams, but will also include opportunities of verbal expression of ideas through written laboratory assignments. macroscopic phenomena with microscopic understanding.

Lab Sections: Lab is a co-requisite for <u>all</u> students except those repeating the course.

Means of assessment:
Half exam (6.8%), three hour exams and final exam (13.3% each): 60%; Attendance: 5%;; Quizzes, assignments, participation: 15%; Lab experiments: 20%

Content:
The course will cover the material of the 2nd portion of the textbook. Labs are as follows:
Experiment 5: Prepartion of Alum
Experiment 4: Conseration of Mass and Percentage Yield
Experiment 18: Volumetric Analysis: Perecentage of Acetic Acid in Vinegar
Experiment 23: Determination of Molar Mass of an Unknown Solute
Experiment 20: Intro to Equilibrium
Experiments 21&22: Spectrochemical Analysis and Equilibrium Constant Determination
Experiment 19: Meaning of pH in a solution
Experiment 24: Buffer Solutions: Preparation and Properties
Experiment 25: Determination of Solubility Product Constant
ELEC 1001R: Redox Chemistry: Activity of Metal <u>or</u> ANAL 1001R: Redox Titration of Iron

Course and Course Number: Chemistry 115 – Principle of Chemistry I; 4 credits (3+3P)

Course Instructors: William Quintana

Catalog Description: Detailed introduction to analytical, inorganic and physical aspects of chemistry; both descriptive and theoretical explanations. Structured for chemistry and biochemistry majors but are appropriate for other physical and life science students.

Prerequisite: MATH 190 or above, B or better in 2nd semester high-school chemistry and an ACT composite score of 22 or higher

Required Texts:

- *CHEMISTRY: The Central* Science, 12th Edition, by Brown, Lemay, Bursten, Murphy and Woodward, Pearson/Prentice Hall.
- *Laboratory Experiments for CHEMISTRY: The Central Science*, by Nelson and Kemp, Pearson/Prentice Hall.

Objectives: CHEM 115 is taught with the following objectives in mind:

1. Present basic chemical principles in important aspects of chemistry, such as matter, atoms, molecules and ions, stoichiometry (calculations and chemical formulas, aqueous reactions and solutions), thermochemistry, electronic structure of atoms, periodicity, chemical bonding and molecular geometry and gas behavior. These topics should prepare you for CHEM 116.
2. Understand the qualitative and quantitative aspects important to chemistry.
3. Help you establish a firm foundation in chemical concepts that will be explored further in higher-level courses that are part of your undergraduate education.
4. Provide a molecular view of chemistry, unique to this particular branch of science.

Lab Sections: Lab is a co-requisite for all students except those repeating the course.

Means of assessment:

Three exams (15% each): 45%; Cllickers and Attendance: 10%; Quizzes: 10%; Lab experiments: 20%, Final Exam: 15%.

Content:

The course will cover the material of the first half of the textbook. Labs are as follows:
Experiment 1: Basic Laboratory Techniques
Experiment 2: Identification of Substances by Physical Porpeties
Experiment 3: Separation of the Component of a Mixture
Experiment 4: Chemical Reactiuons
Experiment.5: Chemical Formulas
Experiment.6: Chemical Reactions of Copper and Percent Yield
Experiment.7: Chemicals in Everyday Life: What are they and how we know?
Experiment.9: Gravimetric Determination of Phosphorus in Plant Food
Experiment.10: Paper Chromatography: Separtions of Cations and Dyes
Experiment.8: Gravimetric Analysis of a Chloride Salt
Experiment.12: Atomic Spectra and Atomic Structure
Experiment.11: Molecular Geometries of Covalent Molecules
Experiment.14: Determination of R, the gas-law constant

Course and Course Number: Chemistry 116 – Principle of Chemistry II; 4 credits (3+3P)

Course Instructors: Deanna (Dede) Dunlavy

Catalog Description: Recommended for chemistry majors and other qualified students.

Prerequisite: C or better in CHEM 115

Required Texts:

- *CHEMISTRY: The Central* Science, 12th Edition, by Brown, Lemay, Bursten, Murphy and Woodward, Pearson/Prentice Hall.
- *Laboratory Experiments for CHEMISTRY: The Central Science*, by Nelson and Kemp, Pearson/Prentice Hall.

Objectives:

The Higher Education Department has identified several common core competencies which the student will achieve through this sequence of science courses (CHEM 115 and 116). The student will:

- describe the process of scientific inquiry
- solve problems scientifically
- communicate scientific information
- apply quantitative analysis to scientific problems
- apply scientific thinking to real world problems

In CHEM 116, these objectives will be realized by stressing the applications of chemistry to the real world in the areas of states of matter from a theoretical basis, solutions, kinetics, thermodynamics, chemical equilibrium (including acids/bases and solubility) and electrochemistry. This will be achieved through traditional assessments such as homework, quizzes and exams, but will also include opportunities of verbal expression of ideas through written laboratory assignments.

Lab Sections: Lab is a co-requisite for all students except those repeating the course.

Means of assessment:

Three exams (15% each): 45%; Attendance: 5%; Quizzes, assignments, participation: 15%; Lab experiments: 20%, Final Exam: 15%.

Content:

The course will cover the material of the second half of the textbook.
The actual schedule of labs is announced during the semester.

Course and Course Number: Chemistry 313 – Organic Chemistry I; 3 credits

Course Instructors: James Herndon

Catalog Description: Nomenclature, uses, basic reactions, and preparation methods of the most important classes of aliphatic and aromatic compounds.

Prerequisite: C or better in CHEM 112G or CHEM 116

Required Texts:
"The Virtual Textbook of Organic Chemistry" which is free at:
http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/intro1.htm.

The normally used textbook is: *Organic Chemistry*, 7th Edition by John McMurry

Objectives and Content:
What will be covered? This class is the first half of a two-semester course in Organic Chemistry; the prerequisite is a course in General Chemistry. The most important General Chemistry concepts are: structure and bonding, electronegativity, and thermodynamics. Organic Chemistry is a qualitative course, not a quantitative course and requires virtually no math; the necessary math skills were taught in the fourth grade of elementary school. The first few weeks of the class are a review of some of the most relevant concepts from General Chemistry. The next few chapters on stereochemistry offer discussions of phenomena unique to trigonal and tetrahedral geometries, and this is the part of the course where the use of models is most applicable. This is followed by a discussion of chemical reactivity, which offers a detailed look at the physical chemistry concepts required to understand organic chemistry concepts. The remaining sections are studies of reactions or organic compounds classified according to functional group; the majority of the second half of the course (CHEM 314) is a continuation of these studies.
Who benefits from a course in organic chemistry? Nearly everyone. Knowledge of organic chemistry offers one a unique perspective on the world and in many ways organic chemistry is consumer awareness as well as a science course. You will find yourself reading food and cosmetic labels. When you see a news report about a new miracle drug, you will be anxious to know its chemical structure. You will also have a greater understanding of current political issues; many bad legislative/legal decisions could easily been avoided if everyone had passed a course in organic chemistry.
Why is organic chemistry a difficult course? There is no universal answer to this question, and some actually find it to be quite easy. Organic chemistry requires a variety of skills, including memorization, extrapolation, working puzzles, and serious thinking. The best way to learn is through doing problems and doing them from scratch. One of the major mistakes students make is to look at the answer to a problem first, and then see how the book got the answer. When you do this the problem seems a lot easier than it really is, and also keep in mind that I have never asked anyone to do this on an exam!

Means of assessment:
Five tests: (100 points each): Homwork (100 points), Final Exam (200 points)

Course and Course Number: Chemistry 313 – Organic Chemistry I; 3 credits

Course Instructors: James Herndon

Catalog Description: Nomenclature, uses, basic reactions, and preparation methods of the most important classes of aliphatic and aromatic compounds.

Prerequisite: C or better in CHEM 112G or CHEM 116

Required Texts:
"The Virtual Textbook of Organic Chemistry" which is free at: http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/intro1.htm.

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Means of assessment:
Five tests (100 points each): 500 points; Homworks, On-line Quizzes: 100 points; Comprehensive Final Exam: 200 points

Course and Course Number: Chemistry 314 – Organic Chemistry II; 3 credits

Course Instructors: James Herndon

Catalog Description: Nomenclature, uses, basic reactions, and preparation methods of the most important classes of aliphatic and aromatic compounds.

Prerequisite: C or better in CHEM 313

Required Texts:
"The Virtual Textbook of Organic Chemistry" which is free at:
http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/intro1.htm.

The normally used textbook is: *Organic Chemistry*, 7^{th} Edition by John McMurry

Objectives and Content:
What will be covered? This class is the second half of a two-semester course in Organic Chemistry. The most important General Chemistry concepts are: structure and bonding, electronegativity, and thermodynamics. Organic Chemistry is a qualitative course, not a quantitative course and requires virtually no math; the necessary math skills were taught in the fourth grade of elementary school. The first few weeks of the class are a review of some of the most relevant concepts from General Chemistry. The next few chapters on stereochemistry offer discussions of phenomena unique to trigonal and tetrahedral geometries, and this is the part of the course where the use of models is most applicable. This is followed by a discussion of chemical reactivity, which offers a detailed look at the physical chemistry concepts required to understand organic chemistry concepts. The remaining sections are studies of reactions or organic compounds classified according to functional group; the majority of the second half of the course (CHEM 314) is a continuation f these studies.
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Means of assessment:
Five tests (100 points each): 500 points; Homworks, On-line Quizzes: 100 points; Comprehensive Final Exam: 200 points

Mathematics 191 - Calculus and Analytic Geometry I; 3 credits

Catalog Description: Algebraic, logarithmic, exponential and trigonometric functions, theory and computation of derivatives, approximation, graphing and modeling. May include an introduction to integration.

Prerequisite: Grade of C or better in Math 190.

Text: *Single Variable Calculus (Early Transcendentals)*, Jon Rogawski, Freeman.

Objectives: The goals are to present the concepts of calculus, stressing techniques, applications, and problem solving, and emphasizing 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. In fulfillment of these goals, this and later courses will stress topics such as polynomial approximation, setting up integrals, differential equations, as well as the use of appropriate technology.

Lab Sections: The fourth hour will be staffed by graduate assistants, and will be run as a problem-solving session, focusing on the common on-line homework problems. This will provide somewhat uniform preparation for the common exams. More individual section work (e.g. projects, other homework) will be done in the hours the instructor teaches. This will help to ensure that GAs running multiple sections are not overburdened.

Other means of assessment: Instructors are encouraged to use reading quizzes, short quizzes based on homework, and other means of assessing student work, especially early in the semester. This helps instructors to learn students' names quickly, to provide regular feedback, and to generate classroom discussion.

Projects: NMSU's Department of Mathematical Sciences has a strong tradition in discovery based learning, especially in calculus courses, including producing one of the MAA's all-time bestseller's "Student Research Projects in Calculus." Instructors are encouraged to give a few to several short projects during the semester. The department has resources for these projects (see the bookcase on the south wall of the reading room) and instructors are encouraged to work with coordinators in developing new or modifying existing projects. Care should be taken so that projects do not run up against exams.

Content:
Trigonometric, exponential, and logarithmic functions (excluding hyperbolic functions)
Rates of change, secant and tangent lines; limits. Review of linear functions
Limit laws, continuity, methods for evaluating limits
Squeeze Theorem; Intermediate Value Theorem
Derivatives; differentiation rules
Rates of change; higher derivatives; derivatives of trigonometric functions
The Chain Rule; implicit differentiation

Revised by Daniel Ramras, December 2009

Mathematics 192 - Calculus and Analytic Geometry II; 3 credits

Catalog Description: Riemann sums, the definite integral, anti-derivatives, fundamental theorems, use of integral tables, numerical integration, modeling, improper integrals, series, Taylor polynomials.

Prerequisite: Grade of C or better in Math 191.

Text: *Single Variable Calculus (Early Transcendentals)*, Jon Rogawski, Freeman.

Objectives: The goals are to present the concepts of calculus, stressing techniques, applications, and problem solving, and emphasizing 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. In fulfillment of these goals, this and later courses will stress topics such as polynomial approximation, setting up integrals, as well as the use of appropriate technology.
Midterm and Final Exams: This course is required to have a uniform common final exam.

Lab Sections: The fourth hour will be staffed by graduate assistants, and will be run as a problem-solving session, focusing on the common on-line homework problems. More individual section work (e.g. projects, other homework) will be done in the hours the instructor

Other means of assessment: Instructors are encouraged to use reading quizzes, short quizzes based on homework, and other means of assessing student work, especially early in the semester. This helps instructors to learn students' names quickly, to provide regular feedback, and to generate classroom discussion.

Projects: NMSU's Department of Mathematical Sciences has a strong tradition in discovery based learning, especially in calculus courses, including producing one of the MAA's all-time bestseller's "Student Research Projects in Calculus." Instructors are encouraged to give a few to several short projects during the semester.

Contents:
Approximating and Computing Area, The Definite Integral
Antiderivatives, The Fundamental Theorem of Calculus
Net or Total change, Substitution
Exponential Growth and Decay, Area Between Two Curves, Density and Average Value
Volume, Volumes of Revolution, Shells (optional)
Work and Energy, Numerical Integration, Integration by Parts
Integration by Parts, Trigonometric Integrals, Trigonometric Substitution
Trigonometric Substitution, Improper Integrals
Arc Length or Fluid Pressure and Force or Center of Mass, Taylor Polynomials
Taylor Polynomials, Sequences
Infinite Series, Convergence Tests, Power Series

Revised by Debra Zarett, May 2010

Mathematics 291 - Calculus and Analytic Geometry III; 3 credits

Catalog Description: Vector algebra, directional derivatives, approximation, max-min problems, multiple integrals, applications, cylindrical and spherical coordinates, change of variables.

Prerequisite: Grade C or better in Math 192.

Text: *Calculus: Early Transcendentals*, by Jon Rogawski, W. H. Freeman and Company, New York.

Objectives: To introduce basic concepts and tools of Analytic Geometry and Multivariable Calculus with strong emphasis on conceptual understanding and applications.

Contents:
The course covers Chapters 12 through 15 of the text. It starts with vectors and analytic geometry in space, then moves to calculus of vector functions, which is presented as a natural extension of one-variable calculus.

The core parts of the course are devoted to techniques and applications of partial derivatives and multiple integrals with special attention paid to their geometric and physical meaning and significance.

An optional topic is an introduction to vector calculus, mainly to vector fields and line integrals. Its main goal is to prepare grounds for higher level courses on Differential Equations and Vector Calculus and to help students to feel more at ease in Engineering and Physics courses that use these notions quite early.

Vectors in the plane and in three dimensions. The dot product.
Cross product. Planes in three-space.
A survey of quadratic surfaces. Cylindrical and spherical coordinates.
Calculus of vector-valued functions.
Applications: arc length, speed, curvature, motion in three-space
Functions of several variables.
Limits and continuity *(very briefly),* Partial derivatives.
Differentiability, linear approximation, tangent planes, and the gradient and directional derivatives.
The Chain rule, optimization in several variables.
Integration in several variables.
Double integrals over more general regions.
Triple integrals
Integration in polar, cylindrical, and spherical coordinates
Change of variables
Vector fields and line integrals

Revised 2/10 by Tiziana Giorgi and Debra Zarret

Mathematics 392 - Ordinary Differential Equations; 3 credits

Catalog Description: An introduction to differential equations in the context of dynamical systems. Modeling, separation of variables, qualitative and numerical methods, equilibria and bifurcations, linear systems, driven oscillations, real and complex solutions. Additions topics optional.

Prerequisite: Grade of C or better in Math 192.

Text: *Differential Equations, Third Edition*, Blanchard, Devaney and Hall. Brooks-Cole, 2006.

Objectives: To introduce basic concepts, theory, methods and applications of ordinary differential equations with emphasis on modeling and dynamics.

Content: The main part of the course is Chapters 1-4 from the text. All sections should be covered with the exceptions of 2.5, 3.8 and 4.5. The dependence of asymptotic behavior of solutions on parameters should be stressed as should bifurcations of equilibria. These aspects can be illustrated graphically using the applets on the DETools CD included with the text. Numerical methods should be also included. The systems approach to higher order equations and eigenvalue methods for solving linear systems should be emphasized. This material will take at least 3/4 of a semester to cover adequately; additional material can be taken from the remaining chapters or other sources depending on the interests of the class and/or the instructor.
The above description has been formulated in consultation with the College of Engineering, the Department of Physics and other client departments. Certain analytical methods have been de-emphasized or eliminated, while dynamics, models, numerical/graphical methods and systems of equations form the core of the course.

Internet Resources: The authors of the text maintain an Internet site as part of the Boston University Ordinary Differential Equations Project. Much useful information is available at http://math.bu.edu/odes. The computers in SH 118 run DETools, Maple and Matlab. Two graphical tools, PPLANE and DFIELD are freely downloadable. They offer numerical and graphical methods that are substantially more flexible and powerful than the DETools.

Contents:
Models of growth and decay, Comparison of analytic, numerical and graphical methods, basic idea of existence/uniqueness, equilibria and bifurcations, linear equations
First order systems, second order equations, oscillations, Euler's method, special analytic techniques, qualitative analysis
Linear systems, superposition, real and complex eigenvalues, behavior along eigenvectors, repeated eigenvalues, zero eigenvalues, trace-determinant plane. Linearization of non-linear systems
Second order linear equations. Forced oscillations and resonance, periodically forced harmonic oscillator, amplitude and phase of asymptotic solutions

Revised by David Pengelley; edited and posted by Liz Eres August 17, 2009.

Appendix B: Faculty Vitae

Engineering Physics

Bachelor of Science in Engineering Physics

Self-Study Report

New Mexico State University

Department of Physics – Faculty and Staff CVs

Name:

Lina Abdallah

Education:

Ph.D. Physics, (spring 2010-present). *New Mexico State University*

M.S. Physics, (2006-2009). *University of Jordan,* Amman, Jordan

B.S. Physics, (2002-2006). *University of Jordan,* Amman, Jordan

Academic Experience:

Lab teaching assistant (summer 2010, fall 2010)

Tutor in Physics Tutoring Room (spring and fall 2010)

Supplemental instruction for PHYS 215 (Engineering Physics I), spring 2011

Supervision of three undergraduate physics research students, spring 2011

Lecturer for PHYS 211 (General Physics I), summer 2011

Physics Research Assistant, summer 2011 to present

Non- Academic Experience:

None

Certification or Professional Registrations:

None

Current Membership in Professional Organizations:

Student member of the Executive Committee of the Four Corners Section (4CS) of the American Physical Society (APS), 2011 to 2015

Honors and Awards:

Preparing Future Faculty Graduate Assistantship Award, New Mexico State University, 2012/13

Service Activities (selected):

Outreach: Perform demonstrations for middle school students during their visits to the Department of Physics at NMSU

Participate in science fair judging for middle school students (White Sands and Sierra Middle Schools; Southwest New Mexico Science and Engineering Fair held at NMSU in March 2012)

Name:

Manal Abdallah

Education:

M.S. Physics, 2009. Yarmouk University, Jordan.

B.S. Physics, 1999. Yarmouk University, Jordan.

Academic Experience:

- New Mexico State University, Department of Physics, Las Cruces, NM: Lab teacher, January 2012- present; full-time.
- Yarmouk University, Department of physics, Irbid, Jordan, Lab teacher, September 2009- January, 2012; Full time.
- Queen Rania Al-Abdallah Academy, Committee for preparing teachers, Irbid, Jordan, A Member in the Jordanian Committee for Preparing Teachers' Learning Material under the supervision of a Group of American Experts from Colombia University, June 2008- June 2009.
- Ministry of education, High school, Irbid, Jordan: A physics teacher, August 1999- September 2009; Full time.

Non- Academic Experience:

None.

Certification or Professional Registrations:

None

Current Membership in Professional Organizations:

None.

Name:

Matthias Burkardt

Education:

Habilitation Physics, 1995. *Universität Erlangen-Nurnberg, Germany*

Ph.D. Physics, 1989. *Universität Erlangen-Nurnberg, Germany*

Diploma Physics, 1987. *Universität Erlangen-Nurnberg, Germany*

Academic Experience:

New Mexico State University, Department of Physics, Las Cruces, NM: Distinguished Achievement Professor, May 2012 – present; Full Professor, August 2004 – May 2012; Associate Professor, August 1999 – August 2004; Assistant Professor, August 1995 - August 1999; full-time

Chair of the NMSU Physics Undergraduate Program, August 2010-present; full-time; Chair of the NMSU Physics Graduate Program, August 2002-August 2008; full-time

Non- Academic Experience:

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 Munchen, 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

Certification or Professional Registrations:

None

Current Membership in Professional Organizations:

Member of the American Physical Society (APS)

Vice Chair of the American Physical Society Group of Hadron Physics

Honors and Awards:

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 (selected):

Physics Undergraduate Program Chair

Regular ***reviewer and referee*** for manuscripts submitted to various journals and grant proposals submitted to various grant agencies

Science and Techonlogy Review Panel Member, Brookhaven National Laboratory and Thomas Jefferson National Accelerator Facility

Important Publications (in past five years, selected):

Angular Momentum Decomposition for an Electron, M. Burkardt and H. BC, Physical Review D79 (2009) 071501

Spin-Polarized High-Energy Scattering of Charged Leptons on Nucleons, M. Burkardt, A. Miller, and W.-D. Nowak, Reports on Progress in Physics 73 (2010) 016201

Are all Boer-Mulders Functions Alike?, Physics Letters B658 (2008) 130

Professional Development Activity (most recent):

More than 100 training hours at the NMSU teaching academy (past five years)

Name:

Michaela Burkardt

Education:

Ph.D. Physics, 1992. *Universität Erlangen-Nürnberg,* Germany

Diploma Physics, 1987. *Universität Erlangen-Nürnberg*, Germany

Graduate Certificate of Online Teaching and Learning, 2008. *New Mexico State University*, NM

Academic Experience:

New Mexico State University, Department of Physics, Las Cruces, NM: College Associate Professor, August 2007 – present; College Assistant Professor, August 2002 - August 2007; part-time

Northeastern University, Department of Physics, Boston, MA, Clinical Lecturer, September 1992 - March 1993

Non- Academic Experience:

New Mexico State University, Teaching Academy, Las Cruces, NM: Faculty Developer (STEM Focus) and Project Coordinator for a Department of Education STEM grant, December 2008 **–** December 2009, full-time, January 2010 – December 2010, part-time

Certification or Professional Registrations:

None

Current Membership in Professional Organizations:

Member of the American Physical Society (APS)

Member of the Topical Group: Physics Education Research of the APS

Member of the American Association of Physics Teachers (AAPT)

Honors and Awards:

College of Arts & Sciences Outstanding College Faculty Award, NMSU**,** April 2012

College of Arts & Sciences Faculty Outstanding Achievement Award, NMSU**,** March 2007

<u>Service Activities (selected):</u>

Physics Tutoring Services Committee Chair

Physics UG Textbook Adoption Committee Chair

Physics Retention Committee Member

Scholarship Committee Member

Society of Physics Students (SPS) Co-Adviser

Reviewer for textbook manuscripts submitted to various publishers

Regular ***consultant*** for the Teaching Academy classroom visitation program

<u>Important Publications</u> (in past five years, selected):

Contributed a chapter (example portfolio) to ***The teaching portfolio: A practical guide to improved performance and promotion/tenure decisions,*** P. Seldin, P., J.E. Miller, and C. Seldin, (2010) San Francisco, CA: Jossey-Bass.

<u>Professional Development Activity (most recent):</u>

Participant, Strategic Programs for Innovations in Undergraduate Physics (Spin-UP), Austin, TX, May 2012

Participant, Teaching Academy, New Mexico State University, Las Cruces, NM, about 150 hours during May 2007 – April 2012

Organizer/Facilitator, Teaching Academy, New Mexico State University, Las Cruces, NM, 25/22 workshops about best practices in teaching for STEM disciplines. Total training provided: 3,628.5 faculty hours. August 2009 – December 2010

Participant, Writing Across the Curriculum, New Mexico State University, Las Cruces, NM, May 2010

Name
Peter Frank de Châtel

Education:
Ph.D. Physics, 1988, *Eötvös University*, Budapest, Hungary
M.Sc. Metallurgical Engineering, 1986, *University of Illinois*, Urbana, IL, USA
B.S. Physics, 1983, *Eötvös University*, Budapest, Hungary

Academic Experience:

Retired since 21 January 2001. Meanwhile:

February to August 2001, Visiting Scientist at *Monash University*, Melbourne, Australia

September 2001 to May 2002, May to December 2003, August to December 2004 and 2005, January to May 2009, 2011 and 2012, Visiting Professor at *New Mexico State University*, Las Cruces, NM, USA

September to December 2002, Visiting Professor at the *University of Michigan*, Ann Arbor, MI, USA

January to March/April 2003, 2004, 2005, 2006, 2007 and 2008, September, October 2009 Visiting Professor at *AlNeelain University*, Khartoum, Sudan

April/May to June 2005, 2006, 2007, 2008, May to June 2009, 2010, 2011 Visiting Scientist at *Institute of Nuclear Research, Hungarian Academy of Sciences*, Debrecen, Hungary

September to November 2010 and 2011 Visiting Scientist at *Institute of Metal Research, Chinese Academy of Sciences*, Shenyang, China

Before retirement:

1980-2001 Professor of Physics at the *University of Amsterdam*, The Netherlands

1974-1980 Reader at the *University of Amsterdam*, The Netherlands

1975 (on leave) Visiting Professor at the *Catholic University of Leuven*, Belgium

1968-1974 Research Associate at the *University of Amsterdam*, The Netherlands

1971-1972 (on leave) Research Assistant at *Cavendish Laboratory*, *University of Cambridge*,

1973-1974 part-time Research Consultant at the *Kamerlingh Onnes Laboratory,University of Leiden*, The Netherlands

Non-Academic Experience:

1983-2001 (part time) Publishing Editor with *Elsevier Science B.V.*, Amsterdam, The Netherlands

Certification or Professional Registrations:

None

Current Membership in Professional Organizations:

None

Honors and Awards:

None

Service Activities (selected):

None

Important Publications (in past five years, selected):

Response of $La_{0.8}Se_{0.2}CoO_{3-\beta}$ to perturbations on the CoO_3 sublattice, Z. Németh, Z. Homonnay, C. Árva, Z. Klencsár, E. Kuzman, A. Vértes, J. Hakl, S. Mészáros, K. Vad, P.F. de Châtel, G. Gritzner, Y. Aoki, H. Konno and J. Greneche, Eur. Phys. J. B **57** (2007) 257

Electronic transport and magnetic properties of the perovskites $La_{0.8}Se_{0.2}Co_{1-x}Fe_xO_3$; $x <= 0.3$, J. Hakl, P.F. de Châtel, S. Mészáros, K. Vad, Z. Klencsár, Z. Németh, Z. Homonnay, A. Vértes, A. Somopoulos, E. Devlin, Y. Aoki, H. Konno, S.K. De, Solid State Sci. **11** (2009) 8.52

Magnetic particle hyperthermia: Néel relaxation in magnetic nanoparticles under circularly polarized field, P.F. de Châtel, I. Nándori, J. Hakl, S. Mészáros and K. Vad, J. Phys.: Condens. Matter **21** (2009) 124202

Uranium at high pressure from first principles, S, Adak, H. Nakotte, P.F. de Châtel, and B. Kiefer**,** Physica B **406** (2011) 3342

Larmor precession and Debye relaxation of single-domain magnetic nanoparticles, Zs. Jánosfalvi, J. Hakl and P.F. de Châtel, submitted to Phys. Rev. E

Name:

Michael DeAntonio

Education:

Ph.D. Physics, 1993. *New Mexico State University*, Las Cruces, NM

M.S. Physics, 1992. *New Mexico State University*, Las Cruces, NM

B.S. Physics, 1984. *Duquesne University*, Pittsburgh, PA

Academic Experience:

New Mexico State University, Department of Physics, Las Cruces, NM: College Associate Professor, August 2004 – present; College Assistant Professor, January 2002 – August 2004, part time

Texas A&M University, Department of Physics, College Station, TX: Visiting Professor, January 1995 – May 1995, full-time

Non- Academic Experience:

LaSen Inc., Las Cruces, NM: Consulting Engineer, February 2008 – present, part time

Army Research Laboratory, White Sands Missile Range, NM: Engineer, May 2002-September 2002, full-time

Delphi Automotive System, El Paso, TX: Engineer/Programmer, June 1997 – April 2000, full-time

GTE Communications Systems, Albuquerque, NM: Member of Technical Staff, January 1985-August 1989, full-time

Certification or Professional Registrations:

None

Current Membership in Professional Organizations:

Member of the Optical Society of America (OSA)

Member and Past Division Chair of the American Society for Engineering Educators (ASEE)

Honors and Awards:

Faculty Development Grant, New Mexico State University (NMSU), College of Arts & Sciences, 2011

<u>Service Activities (selected):</u>

Engineering Physics Committee Member

Advisor for Society of Engineering Physicists

Member of Committee for the Assessment of Student Learning in General Education

Regular ***reviewer and referee*** for manuscripts submitted to various educational conferences

<u>Important Publications</u> (in past five years, selected):

Feasibility Study for the Remote Detection of Atmospheric Xenon Using a DIAL LIDAR System, M. DeAntonio, M, Al-Na'irat, Imaging and Applied Optics: OSA Optics & Photonics Congress Proceedings, (2012)

Criterion 2: A Discussion of ABET Program Educational Objectives, M. DeAntonio, Proceedings from the Annual Conference and Exposition: American Society of Engineering Educators (2012)

Using Microsoft Office in STEM Education, Proceedings from the Annual Conference and Exposition: American Society of Engineering Educators (2012).

A New Set of Learner Classifications for CSET, M. DeAntonio, G. Lee and J. Peterson, Conference Proceedings: Frontiers in Education (2009)

Work in Progress – The Use of Team-Based Learning in an Experimental Physics Lab, M. DeAntonio, L. M. Sandoval, J. Dewald, H. F. Al-Ta'Ani and J. Tallah Conference Proceedings: Frontiers in Education (2007)

<u>Professional Development Activity (most recent):</u>

Division Chair, American Society of Engineering Educators, Vancouver B.C. Canada, June 2011

Name:

Tarlochan S. Dhillon

Education:

Ph.D. Materials Science and Engineering, 1999. *University of Texas, El Paso*

M.S. Engineering Physics, 1972. *Meerut University*, India

B.S. Physics, Math and Cehmistry, 1969, *Punjab University*, Chandigarh, India

Academic Experience:

2006-Present Department Chair, Department of Industrial Technology, Dona Ana Branch Community College (DACC) at NMSU, Las Cruces, NM
2004-2006 Professor, Department of Science and Engineering Technology, Savannah State University, Savanna, GA
2003-2004 Assistant Professor, Department of Physics, University of Texas - Pan America, Edinberg, TX
1987-2003 Instructor AP Physics, Assistant Professor of Physics and engineering at University of Texas – El Paso (UTEP) , and EPISD, El Paso, TX
1981-1987 Professor and Head, Department of Science and Engineering technology, Ramat Polytechnic University, Borno State, Nigeria
1972-1981 Assistant Professor / Associate Professor, Department of Physics and Engineering Physics, Punjab University Chandigarh, UT

Non- Academic Experience:

None

Service and other Synergistic Activities (selected):

- Worked on research projects on simulations of opto-electronics devices and systems. Optical and electronics instrumentation, design of optical devices, materials design and election, digital and logic designs, surface and physical properties of engineering materials, failure of materials and their protection, electroluminescence devices and solar voltaic cells.
- Received research grants combined together in the amount of about three million dollars from NSF, NHF, NPL, and private industry.
- Chaired two PhD dissertations and co-chaired eight others as research advisor for PhD and graduate students.
- Received numerous awards as most influential teacher, program leader, citizen ambassador program, overseas research students award from UMIST, AND National scholarship award.
- Published two text books volume I and volume II on Applied Physics.
- Taught graduate courses such as advanced statistical mechanics, solid state physics, solid state devices, UHV technology, photonic devices, quantum electronics, fiber optic communication and other courses in electrical engineering.

- Continuously developed and improved curriculum for undergraduate students in electronics technology, aerospace and fiber optic communication.

Publications:

T. S. Dhillon, V.P. Singh; *Solid state physics semiconductor devices as a 2D system and its applications to organic electronics devices*, 13.1501330, Dec 16-19, 2008 Technical Program.

T. S. Dhillon, R. Chianelli: Analysis of X-ray Diffraction Pattern of Blue ACTFEL Devices for flat panel display devices using synchrotron radiation. Workshop on Physics of semiconductor devices, National Physical Laboratory, New Delhi, India, December 13-17, 2007

J.A. DeRose, J.P. Revel, T.S. Dhillon, S. Yoyama S. .Linn: *Novel biosensors devices based on molecular protein hetero-multilayer films. Environmental exposures that affect the doctrine system public health implications*, Thin Solid Films 331, 2008, pp. 1-2

T. S. Dhillon, V.P. Singh: *Modeling of the Electroluminescence Behavior of Blue ACTFEL devices with multiple interface energy states*, Proceedings of the thirteenth International Workshop on the Physics of Semiconductors, National Physical Laboratory, New Delhi, India, December 13-17, 2005, pp. 100-107.

T. S. Dhillon, R. Chianelli: *Analysis of X-ray Diffraction Patterns of Blue Sr:Ce ACTFEL Devices for Flat Panel display using Synchrotron Radiation*, Proceedings of the 13th International Workshop on the Physics of semiconductors, National Physical Laboratory, New Delhi, India, December 13-17, 2005, pp. 1159-1162..

Professional Development Activity (most recent):

None

Name:
Michael Engelhardt

Education:
Habilitation, Theoretical Physics, 2001. *Universität Tübingen*, Germany
Ph.D., Physics, 1994. *Universität Erlangen-Nürnberg*, Germany
Diplom, Physics, 1989. *Universität Erlangen-Nürnberg*, Germany

Academic Experience:

New Mexico State University, Department of Physics, Las Cruces, NM: Associate Professor, August 2010 – present; Assistant Professor, March 2004 – August 2010; full-time

Universität Tübingen, Institut f¨ur theoretische Physik, T¨ubingen, Germany: Privatdozent (Lecturer),May 2001 – February 2004, part-time; Research Associate, May 2001 – April 2002; DFG Habilitation Fellow, May 1999 – April 2001; Postdoctoral Research Associate, October 1996 – April 1999; full-time

Universität Erlangen-Nürnberg, Institut für Theoretische Physik III, Erlangen, Germany: Postdoctoral Research Associate, July 1996 – September 1996; full-time

Weizmann Institute of Science, Department of Condensed Matter Physics, Rehovot, Israel: MINERVA Postdoctoral Fellow, May 1994 – June 1996; full-time

Non-Academic Experience:
science+computing ag, *Tübingen*, Germany: IT Consultant, May 2002 – February 2004; full-time

Certification or Professional Registrations:
None

Current Membership in Professional Organizations:
None

Honors and Awards:

Outstanding Referee, American Physical Society, January 2012

DFG Habilitation Fellowship, Deutsche Forschungsgemeinschaft (DFG), 1999-2001

MINERVA Postdoctoral Fellowship, MINERVA Foundation, 1994-1996

Doctorate Fellowship, Ministry of Culture of the State of Bavaria, 1991-1992

Service Activities (selected):

Advisor for NMSU undergraduate Physics majors

Library Liaison for the NMSU Department of Physics

Comprehensive Examination Coordinator (together with Prof. B. Gibbs), NMSU Department of Physics

Regular ***reviewer and referee*** for manuscripts submitted to various journals and grant proposals submitted to various grant agencies

<u>Important Publications</u> (in past five years, selected):

Sivers and Boer-Mulders observables from lattice QCD, B. Musch, P. Hägler, M. Engelhardt, J. Negele and A. Sch¨afer, to appear in Phys. Rev. **D**; arXiv:1111.4249

Center vortex model for the infrared sector of SU(3) Yang-Mills theory: Topological susceptibility, M. Engelhardt, Phys. Rev. **D 83** (2011) 025015

Nucleon structure from mixed action calculations using 2+1 flavors of asqtad sea and domain wall valence fermions, J. D. Bratt, R. Edwards, M. Engelhardt, P. Hägler, H.-W. Lin, M.-F. Lin, H. Meyer, B. Musch, J. Negele, K. Orginos, A. Pochinsky, M. Procura, D. Richards, W. Schroers and S. Syritsyn, Phys. Rev. **D 82** (2010) 094502

Nucleon Electromagnetic Form Factors from Lattice QCD using 2+1 Flavor Domain Wall Fermions on Fine Lattices and Chiral Perturbation Theory, S. Syritsyn, J. D. Bratt, M. Engelhardt, P. Hägler, T. Hemmert, M.-F. Lin, H. Meyer, J. Negele, A. Pochinsky, M. Procura and W. Schroers, Phys. Rev. **D 81** (2010) 034507

Light hadron spectroscopy using domain wall valence quarks on an Asqtad sea, A.Walker-Loud, H.-W. Lin, K. Orginos, D. Richards, R. Edwards, M. Engelhardt, G. Fleming, P. H¨agler, M.-F. Lin, H. Meyer, C. Morningstar, B. Musch, J. Negele, A. Pochinsky, M. Procura, D. Renner, W. Schroers and S. Syritsyn, Phys. Rev. **D 79** (2009) 054502

Nucleon Generalized PartonDistributions from Full Lattice QCD, P. H¨agler,W. Schroers, J. Bratt, R. Edwards, M. Engelhardt, G. Fleming, B. Musch, J. Negele, K. Orginos, A. Pochinsky, D. Rennerand D. Richards, Phys. Rev. **D 77** (2008) 094502

Neutron electric polarizability from unquenched lattice QCD using the background field approach, M. Engelhardt, Phys. Rev. **D 76** (2007) 114502

<u>Professional Development Activities</u> (most recent):

Sabbatical stay at Jefferson National Laboratory, 2011/12 academic year. Initiation of new research projects and collaborations.

Member of PRIMOS (Partnership for Retention and Improvement of Meaningful Opportunities in STEM) faculty cohort at NMSU. Participation in workshops every two weeks throughout the 2009/10 academic year, providing faculty with practical tools and best practices to improve STEM education.

Name:

Elena Fernandez

Education:

B.A. Philosophy, 1998. *New Mexico State University,* USA

Academic Experience:

None

Non- Academic Experience:

New Mexico State University/Los Alamos National Laboratory, Los Alamos Neutron Science Center, Los Alamos, NM: Senior Public Information Specialist, December 2010-Present

Army Research Laboratory/New Mexico State University, Las Cruces, NM: Contractor/R&D Tech III/Specialist, July 2006 – August 2011

New Mexico State University, Department of Physics and Engineering Physics Program, Las Cruces, NM: Specialist, February 2003 – September 2008 | November 2009 – January 2010 (part-time)

New Mexico State University, Department of Engineering Technology and Surveying Engineering, Las Cruces, NM: Enrollment Management Specialist (part-time), October 2008 - January 2010

New Mexico State University, Department of Mechanical & Aerospace Engineering, Las Cruces, NM: Specialist (part-time), November 2008 – May 2009

New Mexico State University, College of Health and Social Services, Las Cruces, NM: Specialist (part-time), January 2009 – April 2009

Camp, Dresser and McKee Inc. (Scientists and Engineers), Las Cruces, NM: Environmental Consultant, May 2001-November 2001

Las Cruces Public Schools, Las Cruces, NM: Part-Time Teacher/Substitute Teacher, May 1999 – December 2002

Certification or Professional Registrations:

Substitute Teacher Certificate (not current)

Registered User – National Oceanic and Atmospheric Administration (NOAA) HYSPLIT - Hybrid Single Particle Lagrangian Integrated Trajectory Model

Current Membership in Professional Organizations:

Member of the Society of Hispanic Physicists

Honors and Awards:

APEX Awards for Publications Excellence, 2011, 2010, 2009, 2008, 2007

"Outstanding Student Award" in Philosophy, co-sponsored by Chicano Programs of New Mexico State University (NMSU) and IBM, 1998

UPC "Volunteer of the Month" February 1998, July 1997, June 1997

Service Activities (selected):

NMSU Engineering Physics Committee Member

Advisor for NMSU Engineering Technology and Surveying Engineering majors

Important Publications:

Fluorescence Spectra and Elastic Scattering Characteristics of Atmospheric Aerosol Particles in Las Cruces, New Mexico, USA: Time Series of Particle Concentrations in Various Spectral Clusters, R. G. Pinnick, E. Fernandez, J. M. Rosen, S.C. Hill, Y. Wang, Y. L. Pan, Atmospheric Environment (Elsevier), Submitted May 2012

Professional Development Activity (most recent):

None

Name:

William R. Gibbs

Education:

Ph.D., Physics, 1961, Rice University
M.S., Physics, 1958, University of Texas
B.S., Physics, 1955, University of Texas

Academic Experience:

Professor, Department of Physics, New Mexico State University, Las Cruces, New Mexico. 1993 − Present:

College Professor, Department of Physics, New Mexico State University,
Las Cruces, New Mexico, 1991 − 1993:

Non- Academic Experience:

Staff Member, Los Alamos Scientific (National) Laboratory, (Group Leader 1973-1975 and 1988-1990) 1962 − 1990

Research Associate, University of Neuchâtel, Switzerland, 1961 − 1962

Certification or Professional Registrations:

None

Current Membership in Professional Organizations:

American Physical Society (Fellow)

Honors and Awards:

Listed in Marquis "Who's Who in America"

Service Activities (selected):

Reviewer of articles in Physical Review C, Physical Review Letters, Nuclear Physics, etc.

Chairman of the comprehensive exam committee.

Associate Editor Physical Review C since October 2008
Professional Development Activities (last seven years):

Attended and presented a talk at the MENU2004 conference, Aug. 29-Sept. 4, 2004 Beijing, China.

Attended several meetings of the American Physical Society

Important Publications (selected, past 7 years):

Pion Charge Exchange on Deuterium, J. P. Dedonder and W. R. Gibbs, Phys. Rev. C, 69, 054611, 2004

The Pentaquark in K+d Total Cross Section Data, W. R. Gibbs, Physical Review C, 70,045208, 2004

A Parallel/Recursive Algorithm, W. R. Gibbs, Journal of Computational Physics, 201, 573, 2004

A Parallel/Recursive Algorithm, W. R. Gibbs, Jour. of Comput. Phys. 201, 573 (2004)

Minimal electromagnetic and mass difference corrections in _N scattering, W. R. Gibbs and R. Arceo, Phys. Rev. C 72, 065205, 2005

The contribution of the light quark condensate to the _N sigma term, W. R. Gibbs, International Journal of Modern Physics A, 20, 1867, 2005

Partial-wave analysis of K+-nucleon scattering, W. R. Gibbs and R. Arceo, Phys. Rev. C 75, 035204, 2007

Professional Development Activity (most recent):

None

Name:

George H. Goedecke

Education:

Ph.D. Physics, 1961, BEE 1954, *Rensselaer Polytechnic Institute*, Troy, NY, USA

Academic Experience:

New Mexico State University, Department of Physics, Las Cruces, NM: Assistant Professor, Associate Professor, Full Professor, September 1961 - August 1995; Department Head, August 1988 - 95; Professor Emeritus, August 1995 **–** present**.** Principal Investigator or co-PI on eight three – year research contracts from U. S. Army Research Office. Taught mainly graduate courses in classical mechanics, electromagnetic theory, quantum mechanics, quantum electrodynamics,
statistical mechanics, plasma physics, solid state physics, mathematical physics, general relativity, and scattering theory, plus undergraduate courses in engineering physics. Research advisor for 13 Ph.D. and four M.S. students.

Montana State University, Department of Physics, Bozeman, MT: Visiting Assistant Professor, September 1968 – May 1969.

University of Idaho, Department of Physics: Visiting Assistant Professor, summer 1969

Non-Academic Experience:

Los Alamos National Laboratory, Visiting Scientist, Summer 1966

U. S. Army Atmospheric Sciences Lab/Army Research Lab (ARL), WSMR, NM:
Visiting Scientist, several summers, 1974 – 1990; Consultant, (Battelle),
several occasions 1974 - 1990 ; Senior Physicist (half-time), 1992 - 95.

Raytheon Missile Systems, Tucson, AZ: Consultant, 2003-2006.

Seldon Laboratories, Windsor, VT: Consultant, 2007-2008.

Certification or Profeessional Registrations:
None
Current Membership in Professional Organizations:
None
Honors and Awards:
None

Service Activities (selected)
NMSU Faculty Senate, 1976 – 1982; Chair, 1980 – 1982.
Regular reviewer for several journals and for grant proposals to Army Research Office.

<u>Recent Important Publications</u> (2006 – present):

G.H. Goedecke, V. Toussaint, and C. Cooper, “On energy transfers in reflection of light by a moving mirror”, to be published in Am. J. Phys., (2012).

G. H. Goedecke, “Global embedding via coordinate basis vectors”, Eur. Phys. J. Plus **126**, 32 (2011); DOI 10.1140/epjp/12011-11032-x

G. H. Goedecke and B. T. Davis, “Continuity relations and quantum wave equations”, Nuovo Cim. **B 125**, 941 (2010); DOI 10.1393/ncb/i2010-10897-y

V. E. Ostashev, S. N. Vecherin, D. K. Wilson, A. Ziemann, and G. H. Goedecke, "Recent progress in acoustic travel-time tomography of the atmospheric surface layer", Meteorologische Zeitschrift **18**(2), 125-133 (2009).

D. K. Wilson, V. E. Ostashev, and G. H. Goedecke, "Quasi-wavelet formulations of turbulence and other random fields with correlated properties", Probabilistic Engineering Mechanics **24**, 343-357 (2009).

D. K. Wilson, V. E. Ostashev, and G. H. Goedecke, "Sound-wave coherence in atmospheric turbulence with intrinsic and global intermittency", J. Acoust. Soc. Am. **124**, No 2, 743-757 (2008).

G. H. Goedecke and S. E. Kanim, "The Hall effect in accelerating and stationary conductors", Am. J. Phys. **75**, 131-138 (2007).

G. H. Goedecke, B. T. Davis, and C. Chen, "Magnetic insulation at finite temperatures", Phys. Plasmas **13**, 083104 (2006).

G. H. Goedecke, D. K. Wilson, and V. E. Ostashev, "Quasi-wavelet models of turbulent temperature fluctuations", Boundary-Layer Meteorology **120,** 1-23 (2006).

S. N. Vecherin, V. E. Ostashev, G. H. Goedecke, D. K. Wilson, and A. G. Voronovich, "Time-dependent stochastic inversion in acoustic travel-time tomography of the atmosphere," J. Acoust. Soc. Am. **119** (5), 2579-2588 (2006).

<u>Professional Development Activities:</u>

More than 100 presentations, publications in proceedings, and discussions at professional society meetings and at NMSU and other universities.

Name:

Thomas Hearn

Education:

Ph.D. Geophysics, 1985. *California Institute of Technology*, Pasadena, CA.

M.S. Geophysics, 1981. *California Institute of Technology*, Pasadena, CA.

B.S. Physics, 1978. *University of California Riverside*, Riverside, CA.

Academic Experience:

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

California Institute of Technology, Seismological Laboratory, Pasadena, CA -Research Assistant, 1978 - 1984; Teaching Assistant, 1983, 1981..

Non- Academic Experience:

Rockwell Science Center, Thousand Oaks, CA, Consultant, May 1983 - Jan. 1984.

Bendix United Geophysical, Richfield, Utah, Field crew worker, Summer 1976.

Certification or Professional Registrations:

None

Current Membership in Professional Organizations:

Member of the American Geophysical Union (AGU)

Member of the Seismological Society of America (SSA)

Member of the Society of Exploration Geophysicists (SEG)

Honors and Awards:

None.

Service Activities (selected):

Member of *NMSU Engineering Physics Committee.*

Advisor for NMSU Engineering Physics Majors

Regular *reviewer and referee* for manuscripts submitted to various journals and grant proposals submitted to various grant agencies

Important Publications **(in past five years, selected):**

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, BXXXXX, doi:10.1029/2011JB008919. In press.

Yue, H., et al. (2012), Lithospheric and upper mantle structure of the northeastern Tibetan Plateau, *J. Geophys. Res.*, 117, BXXXXX, doi:10.1029/2011JB008545. In press.

Bao, X., Sandvol, E., Ni, J. F., Hearn, T. M., Chen, Y. J., Shen, Y. (2011). High resolution regional seismic attenuation tomography in eastern Tibetan Plateau and adjacent regions. Geophysical Research Letters, doi:10.1029/2011GL048012.

Wei, S. et al. (2010), Regional earthquakes in northern Tibetan Plateau: Implications for lithospheric strength in Tibet, *Geophysical Research Letters*, *37*(19), 1-5, doi:10.1029/2010GL044800.

Yang, Y. et al. (2010), Rayleigh wave phase velocity maps of Tibet and the surrounding regions from ambient seismic noise tomography, *Geochemistry Geophysics Geosystems*, *11*(8), 1-18, doi:10.1029/2010GC003119

Hearn, T. M., S. Wang, S. Pei, Z. Xu, J. F. Ni, and Y. Yu (2008), Seismic amplitude tomography for crustal attenuation beneath China, *Geophysical Journal International*, *174*(1), 223-234, doi:10.1111/j.1365-246X.2008.03776.x. Pei, S., J. Zhao, C. A. Rowe, S. Wang, T. M. Hearn, Z. Xu, H. Liu, and Y. Sun (2006), ML Amplitude Tomography in North China, *Bulletin of the Seismological Society of America*, *96*(4A), 1560-1566, doi:10.1785/0120060021.

Professional Development Activity (most recent):

Presenter at 2011 American Geophysical Union Meeting, San Francisco, CA, 5-9 December 2011.

Presenter at *2011 Monitoring Research Review: Ground-based Nuclear Explosion Monitoring Technology*, 2011 MRR Meeting in Tucson, AZ.

Presenter at 2010 American Geophysical Union Meeting, San Francisco, CA, 13-17 December, 2010.

Presenter at 2009 American Geophysical Union Meeting, San Francisco, CA, 14-18 December, 2009.

On Sabbatical at Peking University and guest lecturer, Institute of Theoretical and Applied Geophysics, Fall 2009.

Name:

Stephen Kanim

Education:

Ph.D. Physics, 1999. *University of Washington,* Seattle

Secondary Education Teaching Certification, *San Jose State University,* San Jose, 1984

B.S. Electrical Engineering, 1981. *University of California at Los Angeles,* Los Angeles

Academic Experience:

New Mexico State University, Department of Physics, Las Cruces, New Mexico: Associate Professor, August 2006; Assistant Professor, August 2000 - August 2006; College Assistant Professor August 1998 – August 2000, full time.

University of Maryland, Department of Physics, College Park, Maryland: Visiting Associate Professor, August 2006 – June 2007, full time.

Las Cruces High School, Science Department, Las Cruces, New Mexico: Physics Teacher, August 1987 – May 1992, full time.

Non- Academic Experience:

Applied Micro Technology, Campbell, California: Engineer, June 1985 – July 1987, full time.

Avantek, Incorporated, Santa Clara, California: Engineer, July 1981 – December 1982, full time.

Jet Propulsion Laboratories, Pasadena, California: Technician, 1979 – 1981, part time.

Certification or Professional Registrations:

None

Current Membership in Professional Organizations:

Member of the American Physical Society (APS)

Member of the Four-Corners and Texas Sections of the APS

Member of the American Association of Physics Teachers

Honors and Awards:

College of Arts & Sciences Faculty Outstanding Achievement Award, NMSU**,** October 2009

Service Activities (selected):

Advisor for NMSU Physics majors and for NMSU Physics Graduate Student Organization

Regular ***reviewer and referee*** for manuscripts submitted to various journals and grant proposals submitted to various grant agencies.

Important Publications (in past five years, selected):

nTIPERs: (Newtonian Tasks Inspired by Physics Education Research) C.J. Hieggelke, D.P. Maloney, S. Kanim, Addison Wesley/Pearson, 2012, ISBN 10:0-321-75375-5.

Introductory labs on the vector nature of force and acceleration, K. Subero, S. Kanim, American Journal of Physics **78(5)** (2010).

Accounting for variability in student responses to motion questions, B. Frank, S. Kanim, and L. Gomez,**,** Physical Review Special Topics: Physics Education Research September 2008.

Electromagnetic forces on accelerating current-carrying conductors, G.H. Goedecke and S.E. Kanim, American Journal of Physics **75(2)** (2007).

Professional Development Activity (most recent):

NMSU Teaching Academy, PRIMOS Summer STEM faculty development workshop, Summer 2009.

Name:

Heinrich (Heinz) Nakotte

Education:

Ph.D. Physics, 1994. *Universiteit van Amsterdam*, The Netherlands

B.S. Physics, 1986. *Universität zu Köln,* Germany

Academic Experience:

New Mexico State University, Department of Physics, Las Cruces, NM: Full Professor, August 2009 – present; Associate Professor, August 2003 – August 2009; Assistant Professor, August 1997 - August 2003; full-time

Chair of the Engineering Physics Committee, August 2010-present; full-time

Non- Academic Experience:

Los Alamos National Laboratory, Los Alamos Neutron Science Center, Los Alamos, NM: Postdoctoral Research Associate, May 1994 – April 1996, and September 1996 – August 1997, full-time

Electrotechnial Laboratory, Tsukuba, Japan: Visiting Research Scientist, April-September 1996 – September, full-time

Chalk River Laboratories, Atomic Energy Commission Canada Ltd., Chalk River, Canada: Attached Staff Member, June 1994- July 2000, part-time

Hydraulic Pump Section, Bosh GmbH, Köln, Germany: Staff Member, January-December 1989, part-time

Certification or Professional Registrations:

None

Current Membership in Professional Organizations:

Member of the American Physical Society (APS)

Member of the Four-Corners 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 Topical Group: Magnetism and its Applications of the APS

Member of the Forums of Industrial & Applied Physics and International Physics of the APS

Member of the Neutron Scattering Society of America (NSSA)

<u>Honors and Awards</u>:

Gardiner Professorship, New Mexico State University (NMSU), Department of Physics, 2009-2011

Best Advising Award for Faculty, NMSU, August 2010

College of Arts & Sciences Faculty Outstanding Achievement Award in Scholarship, NMSU**,** October 2009

Award for Exceptional Achievements in Creative Scholarly Activity, NMSU, University Research Council, August 2003

Early CAREER Award, National Science Foundation, December 2000

Science and Technology Agency Fellowship, Japanese Institute for Science and Technology (JISTEC), Japan, April 1996

<u>Service Activities (selected):</u>

Engineering Physics Committee Chair

Advisor for NMSU Engineering Physics majors

Regular ***reviewer and referee*** for manuscripts submitted to various journals and grant proposals submitted to various grant agencies

<u>Important Publications</u> (in past five years, selected):

Thermal expansion in 3d-metal Prussian Blue analogs - A survey study, S. Adak, L.L. Daemen, M. Hartl, D. Williams, J. Summerhill, and H. Nakotte, Journal of Solid State Chemistry **184** (2011) 2854

Uranium at high pressure from first principles, S, Adak, H. Nakotte, P.F. de Châtel, and B. Kiefer**,** Physica B **406** (2011) 3342

Aerosol synthesis and Rietveld analysis of tetragonal (β_1) PdZn, E.J. Petersen, B. Halevi, B. Kiefer, M.N. Spilde, A.K. Datye, J. Peterson, L. Daemen, A.A. Llobet, and H. Nakotte**,** Journal of Alloys and Compounds **509** (2011) 1463

Non-Fermi-liquid behavior in $UCu_{4+x}Al_{8-x}$ compounds, F. Nasreen, M.S. Torikachvili, K. Kothapalli, V.S. Zapf, R. F. Jardim, and H. Nakotte**,** Physica B **406** (2011) 2061

Unusual signatures of the ferromagnetic transition in the heavy-fermion compound UMn_2Al_{20}, C. H. Wang, J. M. Lawrence, E. D. Bauer, K. Kothapalli, J. S. Gardner, F. Ronning, K. Gofryk, J. D. Thompson, H. Nakotte and F. Trouw**, Physical Review B 82 (2010) 094406**

<u>Professional Development Activity (most recent):</u>

Participant, Sunrise Springs Workshop on Catalysis & Electrocatalysis, Santa Fe NM, Nov. 2010

Name:

James Ni

Education:

Ph.D., 1984, *Cornell University* (Geophysics)

M. Engr. 1973, *Cornell University* (Geotechnical Engineering and Remote Sensing)

B. Engr. 1971, *Cornell University*

Academic Experience:

New Mexico State University, Department of Physics, Las Cruces, NM: George W. Gardiner Professor of Physics, January 1012 - December 2013; Full Professor, May 1994 – present; Associate Professor, August 1990 - April 1994; Assistant Professor, August 1984 – July 1990.

Caltech, Department of Geological and Planetary Sciences, Visiting Fellow, Spring 1993.

Columbia University, Lamont-Doherty Earth Observatory, Adjunct Associate Research Scientist, June 1987 – May 1990.

Cornell University, Department of Geosciences, Research Specialists, August 1973 – July 1984.

Certification or Professional Registrations:

None

Current Membership in Professional Organizations:

Member of the Geological Society of America (GSA)

Member of the American Geophysical Union (AGU)

Member of the Seismological Society of America (SSA)

Honors and Awards:

Gardiner Professorship, New Mexico State University (NMSU), Department of Physics 2003-2005 & 2011 -2013

Manasse Chair, New Mexico State University, 2011

Outstanding faculty Achievement Award, NMSU, 2007

AWU-DOE Faculty Professorship, Summer, 2003-2005

Westinghouse Scholarship, 1964-1965

New York State 13th Annual Science Congress Award, 6th Place, 1964

Service Activities (selected):

Senator, NMSU, 2006 – present

Former editor (Solid Earth Geophysics), EOS Transactions, American Geophysical Union

Chairman, 1989 Annual Meeting of the Seismological Society of America

Board member, UNAVCO and IRIS

Advisor of SINOPROBE, China's national program to explore the deep structure of their lithosphere (2010 to present).

Important Publications (in past five years, selected):

Zhang, Q., E. Sandvol, J. Ni, Y. Yang, and Y. J. Chen, Rayleigh wave tomography of the northeastern margin of the Tibetan Plateau, *Earth and Planet. Sci. Lett.*, doi:10.1016/j.epsl.2011.01.021, 2011.

Liang, Xiaofeng, E. Sandvol, Y. J. Chen, T. Hearn, J. Ni, S. Klemperer, Y. Shen, and F. Tilmann, A complex Tibetan upper mantle: A fragmented Indian slab and no south-verging subduction of Eurasian lithosphere, Earth and Planetary Science Letters, in press, 2012

Yang, T., Grand, S.P., Wilson, D., Guzman-Speziale, M., Gomez-Gonzalez, J.M., Dominquez-Reyes, T., and Ni, J., Seismic structure beneath the Rivera subduction zone from finite-frequency seismic tomography, *J. Geophys. Res.*,2009, **114,** B01302, doi:10.1029/2008JB005830, 2009.

Leon-Soto, G., Ni, J.F., Grand, S.P., Sandvol, E., Valenzulea, R.W., Guzman-Speziale, M., Gomez-Gonzalez, J.M., Dominguez-Reyes, T., Mantle flow in the Rivera-Cocos subduction zone, *Geophys. J. Int.*, doi:10.1111/j.1365-246X.2009.04352.x, 2009.

Van Wijk, J., Baldridge, S., van Hunen, J., Goes, S., Aster, R., Coblentz, D., Grand, S., Ni, J., Small scale convection at the edge of the Colorado Plateau: Implications for topography, magmatism and evolution of Proterozoic lithosphere, Geology, v. 38 no. 7; p.611-614; doi:10.1130/G31031.1. July, 2010.

Wilson, D., Aster, R., Grand, S., Ni, J., and Baldridge, W.S., Lithospheric architecture and mantle-supported topography of the Colorado Plateau constrained by receiver function imaging, Geophys. Res. Lett., 37, L20313, doi:10.1029/2010GL044799, October 28, 2010

Professional Development Activity (most recent):

GeoPRISMS Implementation Workshop, Hyatt Lost Pines Resort, Bastrop, TX, January 5-7, 2011

Name:

Vassilios Papavassiliou

Education:

Ph.D. Physics, 1988. *Yale University*, USA

M.Phil. Physics, 1985. *Yale University*, USA

M.S. Physics, 1985. *Yale University*, USA

B.S. Physics, 1982. *Aristotelion University of Thessaloniki*, Greece

Academic Experience:

New Mexico State University, Department of Physics, Las Cruces, NM: Associate Professor, August 2001 – present; Associate Professor; Assistant Professor, August 1995 – August 2001; full-time

Physics Graduate Program Head, August 2010 – present; full-time

Non- Academic Experience:

Fermi National Accelerator Laboratory, Batavia, IL, USA: Visiting Scientist, August 2009 – May 2010, full-time.

Illinois Institute of Technology, Chicago, IL, USA: Senior Research Associate, April 1994 – July 1995, full-time

Argonne National Lab, Chicago, IL, USA: Postdoctoral Appointee, January 1991 – March 1994, full-time

Yale University, New Haven, CT, USA: Research Associate, May 1988 – January 1991, full-time

Certification or Professional Registrations:

None

Current Membership in Professional Organizations:

None

Honors and Awards:

None

Service Activities (selected):

Physics Graduate Program Head

Advisor for NMSU physics graduate students

Important Publications (in past five years, selected):

Measurement of the parity-violating asymmetry in inclusive electroproduction of π^- near the Δ^0 resonance, with D. Androic *et al*. (G0 Collaboration), Physical Review Letters **108** (2012) 122002.

Suppression of back-to-back hadron pairs at forward rapidity in d+Au collisions at $\sqrt{s_{NN}}$=200 GeV, with A. Adare *et al*. (PHENIX Collaboration), Physical Review Letters **107** (2011) 172301.

The G0 experiment: apparatus for parity-violating electron scattering measurements at forward and backward angles,with D. Androic *et al.* (G0 Collaboration), Nuclear Instruments and Methods **A646** (2011) 59.

Cross section and double helicity asymmetry for η mesons and their comparison to neutral pion production in p+p collisions at $\sqrt{s}$=200 GeV, with A. Adare *et al*. (PHENIX Collaboration), Physical Review **D83** (2011) 032001.

Strangeness in the Nucleon, Cold Dark Matter in the Universe, and Neutrino Scattering off Liquid Argon, V. Papavassiliou, AIP Conference Proceedings **1222** (2010) 186.

Renaissance of the ~1 TeV Fixed-Target Program, with T. Adams *et al*., International Journal of Modern Physics **A25** (2010) 777-813.

Measurement of Angular Distributions of Drell-Yan Dimuons in p + p Interactions at 800 GeV/c, with L.Y. Zhu *et al.* (FNAL E866/NuSea Collaboration), Physical Review Letters **102** (2009) 182001.

The polarized gluon contribution to the proton spin from the double helicity asymmetry in inclusive π^0 production in polarized p + p collisions at $\sqrt{s}$ = 200 GeV, with A. Adare *et al*. (PHENIX Collaboration), Physical Review Letters **103** (2009) 012003.

Strange Quark Contribution to the Vector and Axial Form Factors of the Nucleon: Combined Analysis of G0, HAPPEx, and Brookhaven E734 Data, S.F. Pate, D.W. McKee, and V. Papavassiliou, Physical Review **C78** (2008) 015207.

Suppression pattern of neutral pions at high transverse momentum in Au + Au collisions at $\sqrt{s_{NN}}$ = 200 GeV and constraints on medium transport coefficients, with A. Adare *et al*. (PHENIX Collaboration), Physical Review Letters **101** (2008) 232301.

Professional Development Activity (most recent):

Participant, 19th PANIC11: Particles and Nuclei International Conference, Cambridge, MA, USA, July 2011

Name:

Stephen Pate

Education:

Ph.D. Physics, 1987. *University of Pennsylvania*

B.S. Physics, 1981. *North Carolina State University*

Academic Experience:

New Mexico State University, Department of Physics, Las Cruces, NM: Full Professor, August 2006 – present; Associate Professor, August 2001 – August 2006; Assistant Professor, August 1995 – August 2001; full-time

Massachusetts Institute of Technology, Laboratory for Nuclear Science, Cambridge MA: Research Scientist, January 1994 – August 1995; Research Associate, January 1992 – December 1993; full-time

Indiana University Cyclotron Facility, Bloomington, IN: Research Associate, August 1988 – December 1991; full-time

University of Pennsylvania, Philadelphia, PA: Research Associate, August 1987 – August 1988; full-time

Certification or Professional Registrations:

None

Current Membership in Professional Organizations:

Member of the American Physical Society (APS)

Member of the Four-Corners Section of the APS

Member of the Division of Nuclear Physics of the APS

Member of the Topical Group: Hadronic Physics

Member of the American Association of Physics Teachers

Honors and Awards:

Gardiner Professorship, New Mexico State University (NMSU), Department of Physics, 2007-2009

Service Activities (selected):

Physics Department Tenure and Promotion Committee (chair)

Engineering Physics Committee

Advisor for NMSU Physics majors

Regular reviewer and referee for manuscripts submitted to various journals and grant proposals submitted to various grant agencies

Important Publications (in past five years, selected):

Transverse Beam Spin Asymmetries at Backward Angles in Elastic Electron-Proton and Quasielastic Electron-Deuteron Scattering, D. Androić et al. (G0 Collaboration), Phys. Rev. Lett. 107, 022501 (2011)

Cross Section and Parity-Violating Spin Asymmetries of $W^{\pm}$ Boson Production in Polarized p+p Collisions at $\sqrt{s}=500$ GeV, A. Adare et al. (PHENIX Collaboration), Phys. Rev. Lett. 106, 062001 (2011)

J/ψ suppression at forward rapidity in Au + Au collisions at $\sqrt{s_{NN}}=200$ GeV, A. Adare *et al.* (PHENIX Collaboration), Phys. Rev. C 84, 054912 (2011)

Strange Quark Contributions to Parity-Violating Asymmetries in the Backward Angle G0 Electron Scattering Experiment, D. Androić *et al.* (G0 Collaboration), Phys. Rev. Lett. 104, 012001 (2010)

Gluon-Spin Contribution to the Proton Spin from the Double-Helicity Asymmetry in Inclusive π^0 Production in Polarized p+p Collisions at $\sqrt{s}=200$ GeV, A. Adare *et al.* (PHENIX Collaboration), Phys. Rev. Lett. 103, 012003 (2009)

Strange quark contribution to the vector and axial form factors of the nucleon: Combined analysis of data from the G0, HAPPEx, and Brookhaven E734 experiments, Stephen F. Pate, David W. McKee, and Vassili Papavassiliou, Phys. Rev. C 78, 015207 (2008)

Professional Development Activity (most recent):

Presenter of Contributed Talk, Eleventh Conference on the Intersections of Particle and Nuclear Physics, May 29 to June 3, 2012, St. Petersburg, FL

Name:

Christine A. Pennise

Education:

M.S. Electrical Engineering, 1992. *Johns Hopkins University*, Baltimore, MD

B.S. Physics, 1984. *Drexel University*, Philadelphia, PA

Academic Experience:

New Mexico State University, Department of Physics, Las Cruces, NM: Coordinator /Academic Support, September 2001 – present; full-time

Coastal Carolina University, Department of Physics and Chemistry, Conaway, SC: Instructor, August 1998 – February 2000; part-time.

Non- Academic Experience:

AVX Corporation, Myrtle Beach, SC: Electrical Engineer, January 1994 – September 1997 and February 2000 – April 2001(various positions), full-time

US Army Research Laboratory, Adelphi, MD: Electrical Engineer, September 1985 - December 1993(various positions), full-time.

RCA, Inc., Moorestown, NJ: Electrical Engineer, July 1984 - August 1985, full-time.

Certification or Professional Registrations:

None

Current Membership in Professional Organizations:

Member of the American Physical Society (APS)

Member of the American Association of Physics Teachers (AAPT)

Honors and Awards:

Member of Sigma Pi Sigma (Physics Honor Society), inducted 1983 (Drexel University, Philadelphia, PA).

Physics Undergraduate Research Award, 1983 and 1984 (Drexel University, Philadelphia, PA)

National Freshman Honor Society, inducted 1980 (Drexel University, Philadelphia, PA)

Service Activities (selected):

Member of Health and Safety Committee, New Mexico State University, since September 2001.
Chair of Departmental Equipment and Computer Committees, since August 2006.

Important Publications:

None

Professional Development Activity (most recent):

American Physical Society March Meeting, Boston, MA, February 27 – March 2, 2012.

Name:

Jacob Urquidi

Education:

Ph.D. in Physical Chemistry, 2001. *Texas Tech University*, Lubbock, Texas

M.S. in Physical Chemistry, 2000. *Texas Tech University*, Lubbock, Texas

B.S. in Chemistry, *University of Texas at El Paso*, El Paso, Texas

Academic Experience:

Associate Professor of Physics, New Mexico State University, Las Cruces NM 88003, April 2009 – present

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 National Laboratory, Los Alamos, NM, Aug. 2003 – March 2009

Chemistry Faculty, Assistant Professor, South Plains Junior College, Levelland, Texas, Aug. 2000- Aug. 2001

Part time instructor in chemistry, South Plains Junior College, Levelland, Texas, Jan. 2000 – Aug. 2001

Non- Academic Experience:

Postdoctoral Research Scientist on disordered materials at the Intense Pulsed Neutron Source (IPNS), Argonne National Laboratory, Argonne, IL, Aug. 2001 – Aug 2003

Certification or Professional Registrations:

None

Current Membership in Professional Organizations:

American Physical Society (APS)

American Chemical Society (ACS)

Member of the Neutron Scattering Society of America (NSSA)

Honors and Awards:

None

Service Activities (selected):

None

Important Publications (in past five years, selected):

Strontium Environment Transition in Tin Silicate Glasses by Neutron and X-ray Diffraction, J. A. Johnson, J. Urquidi, D. Holland, P. G. Appleyard, Journal of Non-Cryst. Solids, 353, 44-46, pp 4084-4092, 2007

Effect of agitation/flow on the enzymatic digestion of cellulose: a structural study by SANS, M. S. Kent, G. Cheng, J. K. Murton, D. Dibble, F. Zendejas, B. Knierim, H. Tran, B. A. Simmons, J. Urquidi, J. L. Banuelos, R.P. Hjelm; Biomacromolecules, 2010

A 3-meter Pinhole Camera for Anomalous Small Angle Diffraction Measurements, J. L. Banuelos, R. K. Brar, J. Urquidi, In preparation for the Journal of Applied Crystallography

Professional Development Activity (most recent):

Participant: Bruker Webinar on Reciprocal Space Mapping. January 26th, 2012

Name:

Igor Vasiliev

Education:

Ph.D. Materials Science, 2000. *University of Minnesota*, Minneapolis, Minnesota, USA

M.S. Chemical Physics, 1993. *Moscow Institute of Physics and Technology*, Moscow, Russia

B.S. Chemical Physics, 1991. *Moscow Institute of Physics and Technology*, Moscow, Russia

Academic Experience:

New Mexico State University, Department of Physics, Las Cruces, New Mexico: Associate Professor, 2008 – Present.

New Mexico State University, Department of Physics, Las Cruces, New Mexico: Assistant Professor, 2002 – 2008.

University of Illinois at Urbana-Champaign, Department of Physics, Urbana, Illinois: Postdoctoral Research Associate, 2000 – 2002.

Non-Academic Experience:

Institute of Chemical Physics, Chernogolovka, Russia: Junior Staff Member, 1993 – 1994.

Certification or Professional Registrations:

None

Current Membership in Professional Organizations:

Member of the American Physical Society (APS)

Member of the Division of Materials Physics of the APS

Honors and Awards:

J. Tinsley Oden Fellowship, University of Texas at Austin, 2008 – 2009.

Silver Medal Award, Materials Research Society, 1999.

Award for the Best Research Project, Institute of Chemical Physics, Russia, 1993.

Service Activities (selected):

Physics Department Curriculum Committee Chair

Physics Department Computer Committee Chair

Physics Department Colloquium Committee Chair

Engineering Physics Committee Member

Graduate Admissions Committee Member

Regular *reviewer and referee* for manuscripts submitted to various journals and grant proposals submitted to various grant agencies

Important Publications (in past five years, selected):

N. Al-Aqtash and I. Vasiliev, *Ab Initio Study of Boron- and Nitrogen-Doped Graphene and Carbon Nanotubes Functionalized with Carboxyl Groups*, J. Phys. Chem. C **115**, 18500–18510 (2011).

I. Vasiliev and J. R. Chelikowsky, *Real-Space Calculations of Atomic and Molecular Polarizabilities Using Asymptotically Correct Exchange-Correlation Potentials*, Phys. Rev. A **82**, 012502 (2010).

I. Vasiliev, M. Lopez del Puerto, M. Jain, A. Lugo-Solis, and J. R. Chelikowsky, *Application of Time-Dependent Density-Functional Theory to Molecules and Nanostructures*, J. Mol. Struct.: THEOCHEM **914**, 115–129 (2009).

N. Al-Aqtash and I. Vasiliev, *Ab Initio Study of Carboxylated Graphene*, J. Phys. Chem. C **113**, 12970–12975 (2009).

B. Medasani, Y. H. Park, and I. Vasiliev, *Theoretical Study of the Surface Energy, Stress, and Lattice Contraction of Silver Nanoparticles*, Phys. Rev. B **75**, 235436 (2007).

A. Lugo-Solis and I. Vasiliev, *Ab Initio Study of K Adsorption on Graphene and Carbon Nanotubes: Role of Long-Range Ionic Forces*, Phys. Rev. B **76**, 235431 (2007).

Professional Development Activity (most recent):

Participant, March Meeting of the American Physical Society, Boston, Massachusetts, February 27 – March 2, 2012.

Name:

Stefan Zollner

Education:

Ph.D. Physics, 1991. *Universität Stuttgart*, Germany

M.S. Physics, 1987. *Universität Stuttgart*, Germany

B.S. Physics, 1984. *Universität Regensburg*, Germany

Academic Experience:

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:

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.

Certification 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

Member of the American Vacuum Society

Senior Member of the IEEE, Electron Devices Society

Member of the German Physical Society (DPG)

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 Physics Society

Service Activities (selected):

Academic Department Head, Department of Physics, New Mexico State University, since July 2010.

Important Publications (selected):

V.R. d'Costa, C.S. Cook, J. Menendez, J. Tolle, J. Kouvetakis, and S. Zollner, *Transferability of optical bowing parameters between binary and ternary group-IV alloys*, Solid State Commun. **138**, 309 (2006).

J. Taraci, S. Zollner, M.R. McCartney, J. Menendez, M.A. Santana-Aranda, D.J. Smith, A. Haaland, A.V. Tutukin, G. Gunderson, G. Wolf, and J. Kouvetakis, *Synthesis of silicon-based infrared semiconductors in the Ge-Sn system using molecular chemistry methods*, J. Am. Chem. Soc. 123, 10980-10987 (2001).

M. Bauer, J. Taraci, J. Tolle, A.V.G. Chizmeshya, S. Zollner, D.J. Smith, J. Menendez, C. Hu, and J. Kouvetakis, *Ge-Sn semiconductors for band-gap and lattice engineering,* Appl. Phys. Lett. 81, 2992-2994 (2002).

C.S. Cook, S. Zollner, M.R. Bauer, P. Aella, J. Kouvetakis, and J. Menendez, *Optical constants and interband transitions of* $Ge_{1-x}Sn_x$ *alloys (x<0.2) grown on Si by UHVCVD,* Thin Solid Films 455-456, 217-221 (2004).

M.R. Bauer, C.S. Cook, P. Aella, J. Tolle, J. Kouvetakis, P.A. Crozier, A.V.G. Chizmeshya, D.J. Smith, and S. Zollner, *SnGe superstructure materials for Si-based optoelectronics*, Appl. Phys. Lett. 83, 3489 (2003).

Professional Development Activity (most recent):

Biennual Physics Department Chairs Conference, American Center for Physics, College Park, MD, June 8-10, 2012.

Department of Mechanical & Aerospace Engineering Faculty and Staff CVs

Name: Chunpei Cai

Education

Ph.D. in Aerospace Engineering, University of Michigan, Ann Arbor, Michigan, 2005

M.Sc. in Mechanical Engineering, Cornell University, Ithaca, New York , 1999

M.Sc. in Fluid Mechanics, Institute of Mechanics, Chinese Academy of Sciences, 1997

B.Eng. in Naval Architecture, Harbin Engineering University, Harbin, China, 1994

Academic Experience

New Mexico State University, Assistant Professor, Department of Mechanical & Aerospace Engineering, 2008-current, full time.

Non-Academic Experience

ZONA Technology, Scottsdale, Arizona, CFD Specialist, design and implement new gaskinetic CFD schemes, developing new proposals, supervising Project development: 2005-2008, Full time

Altair Engineering, Troy, Michigan, Software Engineer, developing new geometry and meshing technology for sheet metal forming process, 1999-2005, Full Time.

Professional Registrations: none

Current membership in professional organizations:

American Institute of Aeronautics and Astronautics, Senior Member

Thermophysics TC member

American Society of Mechanical Engineering

American Physical Society

American Vacuum Society

Honors and Awards:

Dean Appreciation Award, College of Engineering, NMSU, 2011

Sage Fellowship, Cornell University, 1997/1998

Service Activities

Served as ABET outcome committee member for the MAE Dept.

Participated the Pre-Freshman Engineering Program, NMSU;

Mentor URA participants, for the American Minority Participation (AMP) program in the College of Engineering

Paper Referee for 27 Journals

1. **Name:** Vincent K. Choo
2. **Degrees:**
   B.Sc., ME (Honors), 1977, Nottingham University, U.K.
   Ph.D., Composite Materials, 1982, Liverpool University, U.K.
3. **Academic Experience:**
   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
4. **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
5. **Certifications or professional registrations:** none
6. **Service activities**
   - ME, NMSU, ABET/Undergraduate committee member
   - ME, NMSU, Faculty Peer Review committee member
   - 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
   - Book Review Basic Mechanical Design, by J.E. Shingley McGraw-Hill, September, 1993
7. **Papers:**
   “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
8. **Professional Development**
   - Workshop hosted by the NMSU Teaching Academy: - Documenting Effective Teaching in a Scholarly Manner. *participant*
   - Seminar hosted by the NMSU Teaching Academem - How Good is Good Enough? Setting Assessment Benchmarks or Standards. *participant*

Name: AB Donaldson

Education:
ScD, Mechanical Engineering, New Mexico State University, 1969

Academic Experience:
College Professor, Department of Mechanical Engineering, New Mexico State University, Las Cruces, NM 88003, 1998-Present. (PT)

Visiting Professor of Engineering, New Mexico Highlands University, 1995-1998 (FT)

Visiting Professor and Chemical Engineering Dept. Head, Qatar University, 1990-1993 (FT)

Instructor of Continuing Education, Sandia National Laboratories, 1972-1975 (PT)

Adjunct Professor of Mechanical Engineering, University of New Mexico, 1969-1972 (PT)

Non-Academic Experience:
Enhanced Energy Systems, Inc. August 1981 - May 1989

Sandia National Laboratories June 1969 - August 1981, 2003 - Present (Part Time)

Certifications or Professional Organizations: Registered Professional Engineer in State of New Mexico (Mechanical and Chemical Engineering)

Current Membership in Professional Organizations: ASME

Honors and Awards: None

Service Activities: None

Significant Publications and Presentations Last Five Years:
Measurements in Solid Propellant Plumes at Ambient Conditions", Proceedings of the ASME International Mechanical Engineering Congress and Exposition, November 11-17, 2011, Denver, CO, with Jonathan Height, Walter Gill and Christian Parigger

"Aluminum Response to Fire Heating: Focus on Deformation", presented at the 10th International Symposium on Fire Safety Science, University of Maryland, USA, 19-24 June 2011 with Justin Bowyer, Walter Gill and Anay Luketa

"Thermocouple Response in Fires, Part 1: Considerations in Flame Temperature Measurements by a Thermocouple," Journal of Fire Sciences, November 1, 2010, with A.L. Brundage, W. Gill, S. P. Kearney, V. F. Nicolette and N. Yilmaz

"Combustion of Waste Trap Grease Oil in Gas Turbine Generator", Fuel, v 89, n 3, p 549-553, March 2010. with M.A Al-Shudeifat, "Examination of the Bi-Directional Velocity Probe used in Flames," ASME Fluids Engineering Division Summer Meeting, Paper No. FEDSM2009-78560, August 2-6, 2009, Vail, Colorado, USA. With B. Hogan, H. Bocanegra, R. C. Alarcon, N. Yilmaz, and W. Gill,

Flow Characterization of Diffusion Flame Oscillations Using Particle Image Velocimetry," Experiments in Fluids, Vo. 46, No. 4, pp. 737-746, 2009, with N. Yilmaz, R. E. Lucero and W. Gill

"Imaging of Flame Behavior in a Flickering Methane/Air Diffusion Flame," Journal of Visualization, Vol. 12, No. 1, pp. 47-55, 2009, with N. Yilmaz and R. E. Lucero

"Examination of the Bi-Directional Velocity Probe used in Flames," ASME Fluids Engineering Division Summer Meeting, Paper No. FEDSM2009-78560, August 2-6, 2009, Vail, Colorado, USA. With B. Hogan, H. Bocanegra, R. C. Alarcon, N. Yilmaz, and W. Gill,

"Flow Characterization of Diffusion Flame Oscillations Using Particle Image Velocimetry," Experiments in Fluids, Vo. 46, No. 4, pp. 737-746, 2009, with N. Yilmaz, R. E. Lucero and W. Gill

"Spatial Distribution of Aluminum Particles in Rocket Propellant Plumes at Atmospheric Pressure", 55th JANNAF Propulsion Meeting, May 12-16, 2008 at Boston Marriott, Newton and Hanscom AFB, Newton, Massachusetts, with Brian Hogan and W. Gill.

"Testing Trap-grease Oil in 150kW Gas Turbine", AAAS 83rd Annual Multidisciplinary Meeting, Albuquerque, NM, April 9-12, 2008, with Mohammad Ameen Al-Shudeifat

"CFD Supported Examination of Scaling Issues for Open Wind Tunnel Model Testing" International Journal of Dynamics of Fluids (IJDF) Vol.4 No.1, pp. 1-12, 2008, with Nadir Yilmaz.

"Evidence of PAH Production under Lean Combustion Conditions," Fuel, Vol. 86, pp. 2377-2382, 2007, with Nadir Yilmaz.

"Diffusion Flame Oscillations: Measurements and Correlations," International Journal of Energy Conversion and Management, Vol. 49, No. 11, pp. 3287-3291, 2008, with Nadir Yilmaz, R. E. Lucero.

"Modeling of Chemical Processes in a Diesel Engine with Alcohol Fuels," ASME Journal of Energy Resources Technology, Vol. 129, pp. 355, 2007, with Nadir Yilmaz.

Recent professional development activities

Paper reviewer for ASME meeting presentations, Journal of Fire Science and Fuels

Session chair for two recent ASME meetings

Served on Navy review panel for all university energy research programs

Name: Gabe V. Garcia

Education

Doctor of Philosophy, Civil Engineering, Summer 1996, Texas A&M University.
Master of Science, Mechanical Engineering, Summer 1991, New Mexico State University.
Bachelor of Science, Mechanical Engineering, May 1988, New Mexico State University.

Academic experience

2002 - present	New Mexico State University	Associate Professor
2003- 2005	New Mexico State University	Graduate Program Director
1996 –2002	New Mexico State University	Assistant Professor

Non-academic experience

Summer 2012 Space and Naval Warfare Systems Center – Pacific (SPAWAR)
Summer Faculty Research Program
Conducted research

Summer 2011 Space and Naval Warfare Systems Center – Pacific (SPAWAR)
Summer Faculty Research Program
Conducted research related to the fabrication of large (>50μm in diameter) single crystal silicon (Si) microspheres using lasers.

Summer 1997 University of Texas at El Paso, FAST Center
Visiting Professor

Certifications or professional registrations

None

Current membership in professional organizations

American Society of Mechanical Engineering
American Society for Engineering Education

Honors and awards

2012 Mechanical & Aerospace Engineering Academy Professor of the Year Award
200-2004 NSF Career Award Recipient

Service activities

University Committees: Diversity Council, Athletics Council

College Committees: Curriculum, Effective Teaching and Learning Team

Department Committees: Member of Undergraduate Committee, Member of ABET Committee

Advisor Activities: ME Undergraduate Advisor, Lunabotics Advisor (NASA design competition), Pi Tau Sigma Advisor

Publications and presentations

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.

Professional development activities

Instructor for Dynamics portion of the FE Review (2006-present)

SPIE Smart Structures/NDE – Conference – Attendee (2011)

Faculty-only training for MD Adams, MSC Software, Santa Ana, CA (2010)

ASME Design Engineering Technical Conferences (2009)

Attend MSC Software Webcasts that involve Adams software

Name: Joseph Genin

Education

Ph.D. Engineering Mechanics, University of Minnesota, 1963

M.S. Structural Engineering, University of Arizona

B.S. Civil Engineering, The City College of New York

Academic experience

Professor, Mechanical Engineering Department, New Mexico State University, 1981-present

Professor, Mechanical Engineering Department, Director of the Optics and Material Sciences Laboratory, 1985-1994

Professor, Mechanical Engineering Department, Dean of the College of Engineering , 1981-1985

Purdue University, Head of Engineering Mechanics Division, Professor, Mechanical Engineering Department, 1971-1985

Professor of Aeronautics, Astronautics, and Engineering Sciences, 1968-1973

Associate Professor of Aeronautics, Astronautics, and Engineering Sciences, 1964-1967

University of Minnesota, Instructor of Aeronautics and Engineering Mechanics, 1959-1963

University of Arizona, Instructor of Civil Engineering, 1956-1958

Non-academic experience

Director of Advanced Transportation Center, 1971-1976

General Dynamics Corporation, Fort Worth, Texas, Senior Structures Engineer, 1963-1964

Joseph Genin, Consulting Engineers, Structural design and analysis, 1956-1960

U.S. Army Corps of Engineers (while in the U.S. Army), Miscellaneous design and field projects related to military structures, 1954-1956

Ammann and Whitney, New York, New York, Structural Engineer, 1954

Certifications or professional registrations

Minnesota PE

Current membership in professional organizations

American Society for Engineering Education

American Society of Mechanical Engineers

National Society of Professional Engineers (1981-1986)

American Institute of Aeronautics and Astronautics (1964-1967)

Honors and awards

2001 Mechanical Engineering Academy Professor of the Year

2000 Who's Who Among America's Teachers

1998 Who's Who Among America's Teachers

1990 Elected to grade of "Fellow" by the American Society of Engineers

1985 Honored as 'Colonel, Aide-de-Camp" by Governor of New Mexico

1969 "Best Teacher" by Purdue Chapter of Sigma Gamma Tau

1968 "One of Ten Best Purdue Engineering Teachers"

1967 "One of Ten Best Purdue Engineering Teachers"

Service activities

None

Name: Nathanael J. Greene

Education

Mechanical Engineering /Composite Materials, PhD. in progress

Mechanical Engineering /Combustion Science, MS, December 2004

Mechanical Engineering, BS, May 2002, Iowa State University, Ames, IA, USA

Academic experience

New Mexico State University, Las Cruces, NM

Adjunct Professor August 2011 – Current, part time

NASA White Sands Test Facility, Las Cruces, NM, Instructor January 2007 – Current, part time

American Institute of Aeronautics and Astronautics, Denver, CO, Instructor 2009, part time

Iowa State University, Ames, IA, Teaching Assistant January 2004 – May 2004

Non-academic experience

NASA-White Sands Test Facility, Las Cruces, NM, NASA Project Manager and Aerospace Engineer January 2005 – Current

NASA-Johnson Space Center, Houston, TX, Cooperative Engineer May 2004 – August 2004

NASA-ISU Research Group, Ames, IA, Research Assistant May 2002 – 2005

NASA-White Sands Test Faculty, Las Cruces, NM, Cooperative Engineer August 2003 – January 2004

Keith Cooper & Sons, Ames, IA, Project Manager/Chief Estimator and Salesman 1999 – 2005

Equistar Chemicals, Clinton, IA, Engineering Pump Reliability Co-op 1999

Certifications or professional registrations

None

Current membership in professional organizations

None

Honors and awards

NASA White Sands Test Facility COOP and Intern Mentor 2005-Current

NASA Individual Award, 2011, 2010. 2009, 2008

NASA Power of One Award, 2010

NASA Honor Award, 2010

Knowledge Based Risk Award, 2009

WSTF Composite Pressure Vessels and Structure Chair.

NASA JSC International Space Station 6-Person Crew Award 2009

NASA Safety and Mission Assurance Certificate of Appreciation, 2009

International Association for the Advancement of Space Safety Composite Overwrapped Pressure Vessel Safety and Integrity Workshop Chair, 2008

NASA Space Flight Awareness Team Award, 2008

Service activities

MAE Academy

Publications and presentations

N. Greene, R. Saulsberry, M. Leifeste, T. Yoder, C. Keddy, S. Forth, R. Russell. Composite Overwrapped Pressure Vessel (COPV) Stress Rupture Testing. Proceedings of the 4th International Association for the Advancement of Space Safety May 21, 2010.

N. Greene. Composite Overwrapped Pressure Vessels. Chapter 17.5 in Safety Design for Space Systems (Eds. G. Musgrave, A. Larsen, T. Sgobba), Elsevier Publications 2009.

N. Greene, R. Saulsberry, M. Stevens, B. Webb, P. Taddie. Considerations for the Safe Use of Composites for Pressure and Structural Applications in Cryogenic and Ambient Conditions. Proceedings of the 3rd International Association for the Advancement of Space Safety October 22, 2008.

N. Greene, T. Yoder, R. Saulsberry, B. Forsyth, S. Thorton, R. Wincheski. Progressive Failure Indicators in Composite Overwrapped Pressure Vessels (COPVs). Proceedings of the 54th Joint Army-Navy-NASA-Air Force Propulsion Meeting. May 14-18, 2007.

N. Greene, H. Beeson, R. Saulsberry, T. Yoder, B. Forsyth, M. Carrillo, J. Thesken, D. Revilock, K. Cameron. NASA Space Shuttle and International Space Station Composite Overwrapped Pressure Vessels Accelerated Stress Rupture and Burst Testing to Evaluate Remaining Life. Proceedings of the 54th Joint Army-Navy-NASA-Air Force Propulsion Meeting. May 14-18, 2007.

N. Greene, R. Saulsberry, T. Yoder, B. Forsyth, J. Thesken, S. L. Phoenix. Testing of Full Scale Flight Qualified Kevlar Composite Overwrapped Pressure Vessels. Proceedings of the 48th AIAA ASME ASCHE AHS Structures Conference. Honolulu, HI. April 23-36, 2007.

N. Greene, T. Yoder, R. Saulsberry, L. Grimes-Ledsema, J. Thesken, S. L. Phoenix. Stress Rupture Testing and Analysis of the NASA WSTF-JPL Carbon Overwrapped Pressure Vessels. Proceedings of the 48th AIAA ASME ASCHE AHS Structures Conference. Honolulu, HI. April 23-36, 2007.

N. Greene, D. Ray. The Synergy of Composite Overwrapped Pressure Vessels (COPVs) With Cryogenic Fluid Storage and Propellant Densification. Proceedings of the 10th Aging Aircraft Conference. Palm Springs, CA. April 16-19, 2007.

N. Greene, D. Cone, R. Saulsberry, S. Forth, G. Ecord. Failure Modes for Composite Overwrapped Pressure Vessels (COPVs). Proceedings of the 10th Aging Aircraft Conference. Palm Springs, CA. April 16-19, 2007.

R. Saulsberry, N. Greene, K. Cameron, E. Madaras, L. Grimes-Ledsema, J. Thesken, S. L. Phoenix, P. Murthy, D. Revilock. Nondestructive Methods and Special Test Instrumentation Supporting

NASA Composite Overwrapped Pressure Vessel Assessments. Proceedings of the 48th AIAA ASME ASCHE AHS Structures Conference. Honolulu, HI. April 23-36, 2007.

Professional development activities

None

Name: Harry C. Hardee (Jr), PE, PhD

Education:
BSME University of Texas (Austin) 1959
MSME University of Texas (Austin) 1961
Post Graduate in Nuclear Engineering MIT (1961)
PhD in ME University of Texas (Austin) (1966)

Academic Experience:
Instructor (part time) University of Texas (Austin) 1960-61
Assistant Professor in ME department, NMSU 1966-1967
Professor in ME department, NMSU 1991 – present

Non-academic experience:
Staff Member – Sandia National Labs, 1962-1964
Staff Member – Sandia National Labs, 1967- 1974
Supervisor Heat Transfer Division – Sandia, 1974-1979
Supervisor Geothermal Research Division – Sandia, 1979-1982
Supervisor Geophysics Division – Sandia, 1982-1991

Certifications and Registrations:
Registered Professional Engineer – Texas – (Regis. No. 64579)
Registered Professional Engineer – New Mexico (Regis. No. 4393)
Certification in New Mexico for Mechanical and Geological Enigneering

Current Membership in Professional Organizations: None

Honors and Awards:
1961 USAEC Special Fellowship in Nuclear Science and Engineering
1964 R. C. Baker Fellowship
1965 Alcoa Fellowship
1991 NEDO Specialist Invitation Award by Japanese Government
1991 Sandia National Lab "Award for Excellence" for scientific research
2002 ME Academy Professor Award

Service Activities:

2009-2012 Representative on NMSU Faculty Senate
2010-2012 Representative on NMSU President's Budget Committee

Publications and Presentation in past 5 years: None

Recent Professional Development Activities:
Developed New Courses for ME department in Nuclear Systems and Automotive Systems

Name: Young S. Lee

Education

Ph.D., Mechanical Engineering, University of Illinois at Urbana-Champaign (UIUC), 2006

M.Eng., Mechanical Engineering, Inha University, South Korea, 1995

B.Eng. ., Mechanical Engineering, Inha University, South Korea, 1993

Academic Experience

Assistant Professor (100%), Department of Mechanical & Aerospace Engineering, New Mexico State University (NMSU), 2008-present

Visiting Scholar (0%), Department of Aerospace Engineering, UIUC, 2011-present

Postdoctoral Research Associate (100%), Department of Aerospace Engineering, UIUC, 2007-2008

Visiting Assistant Professor (100%), Departments of Mechanical Science and Engineering, and Aerospace Engineering, UIUC, 2006-2007

Research / Teaching Assistant (50%), Department of Mechanical Science and Engineering, UIUC, 2002-2006

Lecturer (50%), Halla University, South Korea, 2001-2002

Non-academic Experience

Researcher (100%), Choongwae Medical Co., South Korea, 1999-2001

Researcher (100%), Kumho Institute of Construction Co., South Korea, 1995-1998

Certifications / Professional Registrations: none

Current Membership in Professional Organizations

American Society of Mechanical Engineers (ASME)

American Institute of Aeronautics and Astronautics (AIAA)

Society for Experimental Mechanics (SEM)

American Society for Engineering Education (ASEE)

Honors and Awards

2008 Professional Engineering (PE) Publishing Award

Mavis Memorial Fund Fellowship, College of Engineering, UIUC, 2005–2006

Service Activities

(within the Institution)

Mechanical Engineering Faculty Search Committee, 2011–2012

Aerospace Engineering Faculty Search Committee, 2009–2010

Consulting Members for Aerospace Program ABET and Graduate Course Committees, 2008–2011

Graduate Program Committee, 2010-present

(outside the Institution)

Conference Co-organizer / Session Chairs, ASME 2012 International Design Engineering Technical Conferences (IDETC) and Computers and Information in Engineering Conference (CIE)

Conference Session Chairs, 2011 European Mechanics Society (EUROMECH) European Nonlinear Oscillations Conference (ENOC), and ASME 2011 International Design Engineering Technical Conferences (IDETC) and Computers and Information in Engineering Conference (CIE)

Journal Referee Activities (Physica D, ASME Journal of Applied Mechanics, Journal of Fluids and Structures, AIAA Journal, Journal of Sound and Vibration, ASME Journal of Vibration and Acoustics, Journal of the Acoustical Society of America)

Selected Publications / Presentations in the Past 5 Years

Lee, Y.S., Tsakirtzis, S., Vakakis, A.F., McFarland, D.M., and Bergman, L.A., 'A time-domain nonlinear system identification method based on multiscale dynamic partitions,' *Meccanica*, 46, 625–649, 2011

Lee, Y.S., Vakakis, A.F., McFarland, D.M. and Bergman, L.A., 'A global-local approach to system identification: A review,' *Structural Control and Health Monitoring, Special Issue dedicated to Professor G.W. Housner*, 17(7), 742–760, 2010.

Tsakirtzis, S., Lee, Y.S., Vakakis, A.F., Bergman, L.A., and McFarland, D.M., Modeling of nonlinear modal interactions in the transient dynamics of an elastic rod with an essentially nonlinear attachment, *Communications in Nonlinear Science and Numerical Simulations*, 15 (9), 2617–2633, 2010.

Lee, Y.S., Vakakis, A.F., McFarland, D.M., and Bergman, L.A., 'Nonlinear system identification of the dynamics of aeroelastic instability suppression based on targeted energy transfers,' *The Aeronautical Journal* 114 (1152), 61–82, 2010.

Lee, Y.S., Tsakirtzis, S., Vakakis, A.F., Bergman, L.A., and McFarland, D.M., 'Physics-based foundation for empirical mode decomposition,' *AIAA Journal* 47 (12), 2938–2963, 2009

Lee, Y.S., Nucera, F., Vakakis, A.F., McFarland, D.M., and Bergman, L.A., 'Periodic orbits and damped transitions of vibro-impact dynamics,' *Physica D* 238 (18), 1868–1896, 2009.

Lee, Y.S., Vakakis, A.F., Bergman, L.A., McFarland, D.M., Kerschen, G., Nucera, F., Tsakirtzis, S., and Panagopoulos, P.N., 'Passive nonlinear targeted energy transfer (TET) and its applications to vibration absorption: A review,' *Proceedings of the Institution of Mechanical Engineers, Part K, Journal of Multi-Body Dynamics* 222 (2), 77–134, 2008.

Vakakis, A.F., Gendelman, O., Bergman, L.A., McFarland, D.M., Kerschen, G., and Lee, Y.S., *Passive Nonlinear Targeted Energy Transfers in Mechanical and Structural Systems Parts I and II*, Springer-Verlag, 2009.

Professional Development Activities

Participation in NMSU Teaching Academy Seminars, 2008-2009

Participation in NMSGC GRASP (Gaining Retention and Achievement for Students Program), 2008

Name: Ian Leslie

Education

Ph.D. Mechanical Engineering, Stanford University, 1984

M.S. Mechanical Engineering, University of Michigan, 1977

B.S. Mechanical Engineering, University of California at Berkley, 1976

Academic experience

1984-2010 Associate/Assistant Professor, Mechanical Engineering Department, New Mexico State University

2011-2012 Associate/Interim Department Head, Mechanical Engineering Department, New Mexico State University

Non-academic experience

Consulting for Livingston Associates and Star Labs

Certifications or professional registrations

None

Current membership in professional organizations

American Society of Mechanical Engineers

Honors and awards

Teaching and service award from Mechanical Engineering Advisory Committee, Feb 2009

Service activities

Interim Department Head (Aug 2011 – present)

Associate Department Head (Jan 2011 – July 2011)

Member of ABET Outcomes and Assessment Committee (2006-2012)

Search chair for CFD position in Mechanical Engineering (2005-2006)

Paper review for ASEE, Mar 2009.

Paper reviews for ASEE, Feb 2008.

Publications and presentations

Final report to Sandia National Laboratories, Hurricane Mitigation, June 2010

Curved Nozzle Technology for Removal of Suspended Materials from Water, Progress report to ONR, December 2008.

Improving Fire Behavior Modeling Using Prescribed Burns In The Southwest, Final Report for Joint Venture Agreement with US Forest Service, 03-JV-11221615-094, October 2007.

Professional development activities

Attended Effective Teaching workshop Jan 12-13, 2012

Attended How to Evaluate Teaching workshop Jan 13, 2012

Name: Ou Ma

Education

Ph.D., 1991, Mechanical Engineering and Center of Intelligent Machines (CIM), McGill University, Montreal, Canada

M.Eng, 1987, Mechanical Engineering and Center of Intelligent Machines (CIM), McGill University, Montreal, Canada

B.Sc., 1982, Mechanical Engineering, Zhejiang University, Hangzhou, China.

Academic experience

August 2008, Professor (tenured), Department of Mechanical & Aerospace Engineering, New Mexico State University 1040 S. Horseshoe St., Jett Hall 111, Las Cruces, NM 88003, USA

January 2010 – July 2010, Senior Visiting Scientist, German Space Operations Center (GSOC), German Aerospace Center (DLR) Wessling, 81241, Germany

August 2002 – July 2008, Associate Professor, Department of Mechanical & Aerospace Engineering, New Mexico State University 1040 S. Horseshoe St., Jett Hall 111, Las Cruces, NM 88003, USA

June 2004 – July 2004, Visiting Professor, Spacecraft Technologies Branch, Canadian Space Agency 6767, Route de l'Aéroport, Longueuil (St-Hubert), QC, Canada, J3Y 8Y9

Non-academic experience

July 1991 - July 2002, Senior R&D technical leader and project engineer, MDA Space Missions 9445 Airport Rd., Brampton, Ontario, Canada L6S 4J3

July 1991 - June 1997, Senior engineer, Control and Analysis Department, MDA Space Missions (used to called “Spar Aerospace Ltd.” and “MD Robotics Ltd”) 9445 Airport Rd., Brampton, Ontario, Canada L6S 4J3

Certifications or professional registrations

Registered Professional Engineer (PEO), Ontario, Canada

Current membership in professional organizations

American Society of Mechanical Engineers (ASME)

Institute of Electrical and Electronics Engineers (IEEE)

American Institute of Aeronautics and Astronautics (AIAA)

Honors and awards

DAAD (German Academic Exchange Fellowship) award for senior visiting scientist, 2010.

Outstanding professor, Mechanical Engineering Academy, NMSU, 2008.

NRC (National Research Council) Summer Faculty Fellowship award, 2005.

Technical Innovation Award: Contact Dynamics Toolkit (CDT), MDA Space Missions, 2000.

Technical Innovation Award: Contact Dynamics Modeling and Simulation, MD Robotics, 1996.

FCAR Graduate Fellowship, Quebec, Canada, 1987-1990 (during Ph.D. study at McGill).

David Stewart Memorial Fellowship award, McGill University, 1985-1986.

Service activities

Member of the University's Academic Review Board (2012 –)

Member of the University's Graduate Council (2010 – 2013)

Member of the College of Engineering's Distinguished Professors Selection Panel (2012)

Member of the Aerospace Engineering Program Committee (2003 –)

Faculty mentor for the NMSU Advance Program (2008 –)

Publications and presentations

"STVF – A Canadian Version of EPOS", an invited presentation at the German Aerospace Center (DLR), Wessling, Germany, May 7, 2010.

"New Gravity-Offloading Technology for Simulating Human Activities on the Moon or Mars", a presentation to a NASA JSC delegation to NMSU, September 24, 2009.

"Ground based Verification of Contact Tasks of Space Robots", an invited presentation at Beijing Post and Telecommunication University, Beijing, July 28, 2009.

"Passive Reduced-G Mechanism for Simulating Walking on the Moon/Mars", an invited presentation at the Johnson Space Center, NASA, Houston, Feb. 19, 2009.

"On-Orbit Identification of Inertia Properties of Spacecraft Using Robotics Technology", an invited seminar at Ryerson University, Toronto, November 27, 2008.

"Cable Driven Robotic Systems for Space and Healthcare Applications", an invited seminar at the Nanjin University of Aeronautics and Astronautics, Nanjing, China, June 27, 2008.

"Cable-Robot based Reduced-Gravity Simulation for EVA Training", an invited presentation at the Johnson Space Center, NASA, Houston, Jan. 25, 2008.

"Contact Dynamics Model Parameters Identification and Model Order Reduction", an invited presentation at the Johnson Space Center, NASA, Houston, Jan. 24, 2008.

"Hardware-in-the-Loop Simulation Technology for Space Applications", an invited presentation at Tsinghua University, Beijing, Jan. 8, 2008.

"Cable Driven Robotic Systems for Healthcare Applications", an invited presentation at Shenzhen Institute of Advanced Technology, Chinese Academy of Science, Shenzhen, China, Jan. 4, 2008.

"Hardware-in-the-Loop Microgravity Contact Dynamics Simulation using A 6-DOF Cable Robot", an invited seminar at the Institute of Artificial Intelligent Machines, Chinese Academy of Science, Hefei, China, Dec.27, 2007.

"Techniques for Significantly Speeding up Contact Dynamics Simulation of a Multibody System", an invited presentation at the Army Research Laboratory, ARL/APG, Aberdeen, MD, May 15, 2007.

Name: Young Ho Park

Education

Ph.D. Mechanical Engineering, University of Iowa, 1994

M.S. Mechanical Design & Production Engineering, Seoul National University, 1988

B.S. Mechanical Engineering, Seoul National University, 1986

Academic experience

2000-present, Assistant Professor, New Mexico State University

1999-2000, Adjunct Assistant Professor, University of Iowa

1996-2000, Research Scientist, Center for Computer-Aided Design, University of Iowa

1991-1994, Research Scientist, Center for Computer-Aided Design, University of Iowa

Non-academic experience

1994-1996, Research Engineer, Ford Motor Company

Certifications or professional registrations

None

Current membership in professional organizations

American Society of Mechanical Engineers

American Institute of Aeronautics and Astronautics

Korean-American Scientist and Engineers Association

Association of Korean-American Professionals in Automotive Industries

Honors and awards

2004 Mechanical Engineering Academy Professor of the Year

2003 Outstanding Teacher, NMSU ASME/Pi Tau Sigma Student chapters

2003 Mechanical Engineering Innovative Teaching Award, NMSU

2002 Who's Who in Engineering Education

2001 Cited in Strathmore's Who's Who

2001 Outstanding Teacher, NMSU ASME/Pi Tau Sigma Student chapter

Publications

Young Ho Park and Jun Tang, "Optimal Replacement Decision of Mechanical Components for Fatigue Failure," *International Journal of Fatigue,* 2005 (submitted).

Young H. Park, "Rigid Plastic Meshfree Analysis for Metal Forming Simulation." *Journal of Computers and Structures*, 2004 (under review)

Young Ho Park and Jun Tang, "An Efficient Methodology for Fatigue Reliability Analysis for Mechanical Components," *ASME Journal of Pressure Vessel Technology*, 2004 (under review).

Byeng D. Youn, Kyung K. Choi, and Young H. Park, "Hybrid Analysis Method For Reliability-Based Design Optimization," *ASME Journal of Mechanical Design*, 125, 221-232, 2003.

Chen, G., Rahman, S., and Y. H. Park, "Shape Sensitivity Analysis of Linear-Elastic Cracked Structures," *Journal of Pressure Vessel Technology – Transactions of the ASME*, Vol. 124, No. 5, 2002. pp. 476-482.

N.H. Kim, Y.H. Park, and K.K. Choi, "An Optimization of Hyper-Elastic Structure with Multibody Contact Using Continuum-Based Shape Design Sensitivity Analysis," *Structural Optimization*, Vol. 21, No.3, 2001, pp. 196-208.

Guofeng Chen, Sharif Rahman, and Young Ho Park, "Shape Sensitivity and Reliability Analyses of Linear-Elastic Cracked Structures," *International Journal of Fracture*, Vol. 112, 2001, pp. 223-246.

Kyung K. Choi, Jian Tu, and Young H. Park, "Extension of Design Potential Concept for Reliability-Based Design Optimization to Non-Smooth and Extreme Cases," *Structural and Multidisciplinary Optimization*, Vol. 22, No. 5, pp. 335-350, 2001.

Guofeng Chen, Sharif Rahman, and Young Ho Park, "Shape Sensitivity Analysis in Mixed-Mode Fracture Mechanics," *Computational Mechanics*, Vol. 27, 2001, pp. 282-291.

Jian Tu, Kyung K. Choi, and Young H. Park, "Design Potential Method for Robust System Parameter Design," *AIAA Journal*, 2001, Vol. 39, No.4, pp.667-677.

Name: Bashar Qawasmeh

Education

Doctor of philosophy in Mechanical Engineering, New Mexico State University(NMSU), Las Cruces, New Mexico (May 2012)

Master of science in Mechanical Engineering, New Mexico State University(NMSU), Las Cruces, New Mexico (August 2008)

Master of science in Mechanical Engineering, Jordan University of Science and Technology(JUST), Irbid, Jordan (June 2005)

Bachelor of science in Mechanical Engineering (Mechatronics), Jordan University of Science and Technology(JUST), Irbid, Jordan (August 2002)

Academic experience

Assistant college professor, Department of Mechanical & Aerospace Engineering, (NMSU), Fall 2012

Instructor, ME338 ”Fluid Mechanics”, and AE447 “Aero-fluids lab” (NMSU), Spring 2010-present

Research Assistant, (NMSU) , Fall 2007-present

Teaching Assistant, ME345 “Experimental Methods I”, (NMSU) , Spring 2007

Instructor (Thermal-Power stream), Al-Quds College, Amman, Jordan, Fall 2005-2006

Research Assistant/ Teaching Assistant, (JUST) , Spring 2003-2006

Non-academic experience

None

Certifications or professional registrations

None

Current membership in professional organizations

None

Honors and awards

None

Service activities

None

Publications and presentations

B. R. Qawasmeh, and M. Wei, Low-dimensional model and its sensitivity study for compressible temporal shear layers, to be submitted, 2012

M. Wei, B. R. Qawasmeh, M. Barone, B. G. van Bloemen Waanders, and L. Zhou, Low-dimensional model of spatial shear layers, *Physics of Fluids*, Vol. 24, No. 014108, doi: 10.1063/1.3678016, 2012

M. Wei, B. R. Qawasmeh, M. Barone, and B. G. van Bloemen Waanders, Low-dimensional modeling for spatially developing free shear layers, *AIAA paper* 2009-363, Orlando, FL, 2009

B. R. Qawasmeh, and M. Wei, A least order model for temporally-developing compressible shear layers, *Bulletin of the American Physical Society*, Vol. 55, No. 16, Long Beach, CA, 2010

B. R. Qawasmeh, and M. Wei, Projection of spatial shear layers in a symmetry-reduced space, *Bulletin of the American Physical Society*, Vol. 53, No. 15, San Antonio, TX, 2008

Professional development activities

None

Name: Amit K. Sanyal

Education

Ph.D. 2004 – Aerospace Engineering, University of Michigan

M.S. 2004 - Mathematics, University of Michigan

M.S. 2001 - Aerospace Engineering, Texas A&M University

B.Tech. 1999 - Aerospace Engineering, I.I.T. Kanpur

Academic experience

Assistant Professor, Mechanical & Aerospace Engineering, New Mexico State University, 2010-Present

Assistant Professor, Mechanical Engineering, University of Hawaii, 2007-2010

Post-doctoral Research Associate, Arizona State University, 2004-2006

Non-academic experience

Consultant for Pukoa LLC, Hawaii, on autonomous navigation for UAVs

Certifications or professional registrations

None

Current membership in professional organizations

American Institute of Aeronautics and Astronautics (AIAA)

Institute of Electrical and Electronics Engineers (IEEE)

Society for Industrial and Applied Mathematics (SIAM)

Association for Unmanned Vehicle Systems International (AUVSI)

Honors and awards

Distinguished Graduate Student Masters Research Award, Texas A&M University

Engineering Academic Scholar Certificate, University of Michigan

Service activities

Member of ABET committee for Aerospace Engineering (NMSU).

Technical committee memberships: AIAA Guidance, Navigation and Control Technical Committee (2008 to 2011), IEEE Technical Committee on Aerospace Control (since 2009).

Conference Activities: Chairs of general and invited sessions at American Control Conference; AIAA Guidance, Navigation and Control Conference; IEEE Conference on Decision and Control.

Technical program committee member for 2010 AIAA GN&C conference and 2010 IEEE Conference on Decision and Control.

Reviewer for: AIAA J. of Guidance, Control and Dynamics; IEEE Trans. On Auto. Control; IEEE Trans. On Cont. Sys. Tech.; Automatica; Systems and Control Letters; SIAM J. on Cont. and Optimization; ASME J. of Dyn. Systems, Meas. And Control; AIAA GN&C conference; Amer. Cont. Conference; IEEE Conf. Decision and Control.

Publications and presentations

K. Sanyal and N. Nordkvist, "Attitude State Estimation with Multi-Rate Measurement for Almost Global Attitude Feedback Tracking", AIAA J. Guidance, Control and Dynamics, 35(3), pp. 868-880, 2012.

A.K. Sanyal, N. Nordkvist and M. Chyba, ``An Almost Global Tracking Control Scheme for Maneuverable Autonomous Vehicles and its Discretization," IEEE Trans. on Auto. Control, 56(2), pp. 457-462, 2011.

K. Sanyal, A. Fosbury, N. A. Chaturvedi, and D. S. Bernstein, ``Inertia-Free Spacecraft Attitude Tracking with Disturbance Rejection and Almost Global Stabilization," AIAA J. of Guidance, Control and Dynamics, 32(4), pp. 1167-1178, 2009.

M. Bloch, I. I. Hussein, M. Leok, and A. K. Sanyal, ``Geometric structure-preserving Optimal Control of the Rigid Body," J. of Dynamical and Control Systems, 15(3), pp. 307-330, 2009.

K. Sanyal, A. M. Bloch, P. E. Crouch, and J. E. Marsden, ``Optimal Control and Geodesics on Quadratic Matrix Lie Groups," Foundations of Computational Mathematics, 8(4), pp. 469-500, 2008.

K. Sanyal, T. Lee, M. Leok, and N. H. McClamroch, ``Global Optimal Attitude Estimation using Uncertainty Ellipsoids," Systems and Control Letters, 57(3), pp. 236-245, 2008.

Professional development activities

Reviewer for National Science Foundation

Name: Ma'en Sari

Education

Ph.D. Mechanical Engineering, New Mexico State University, May 2011

M.Sc. Mechanical Engineering, Jordan University of Science and Technology, May 2005

B.Sc. Mechanical Engineering, Jordan University of Science and Technology, August 2002

Academic experience

College assistant professor, New Mexico State University, 2010-Present

Graduate research assistant, New Mexico State University, August 2006-Present

Graduate teaching assistant, New Mexico State University

Non-academic experience

None

Certifications or professional registrations

None

Current membership in professional organizations

None

Honors and awards

None

Service activities

None

Publications and presentations

Butcher, E.A., Sari, M., Bueler, E., Carlson, T.: Magnus' Expansion for Time Periodic Systems: The 12th conference on Nonlinear Vibrations, Dynamics, and Multibody Systems, Blacksburg, VA, June 1-5, 2008.

Butcher, E.A., Sevostianov, I., Sari, M., Al-Shudeifat, M.: Use of Nonlinear Vibration Frequencies and Electrical Conductivity Measurements in the Separation of Internal and Boundary Damage in Structures, Proceedings of IMECE2008 ASME International Mechanical Engineering
Congress and Exposition, Boston, MA, Oct. 31-Nov. 6, 2008.

Sari, M. and Butcher, E.A.: Natural Frequencies and Critical Loads of Beams and Columns with Damaged Boundaries Using Chebyshev Polynomials: 9th Annual Raytheon Company

Mechanical, Materials and Structural Technology Network Symposium (MMSTN09) University
Session, Tucson, AZ, October 22nd, 2009.

Butcher, E.A. and Sari, M.: Free Vibration Analysis of Kirchoff Plates with Damaged Boundaries by the Chebyshev Collocation Method, Symposium on Mechanics of Slender Structures (MOSS 2010), Donostia – San Sebastian, Spain, July 21-23, 2010.

Sari, M. Nazari, M., and Butcher, E.A., Free Vibration Analysis of Kirchoff Plates with Damaged Boundaries by the Chebyshev Collocation and Perturbation Methods, ASME Conference on Smart Materials, Adaptive Structures, and Intelligent Systems, Philadelphia, PA, Sep. 28-Oct. 1, 2010.

Sari, M.S. and Butcher, E.A.: Three Dimensional Vibration Analysis of Rectangular Plates with Undamaged and Damaged Boundaries by the Spectral Collocation Method, ASME 2011 International Design Engineering Technical Conference (CIE), Washington, DC, August 28-31, 2011.

Professional development activities

Teaching Academy

Name: Fangjun Shu

Education

PhD, Dec. 2005, Mechanical Engineering (Experimental Fluid Mechanics)

M.S. Purdue University, West Lafayette, IN, USA Jun. 2000, Mechanics and Mechanical Engineering (Optical Metrology)

B.S. University of Science and Technology of China, Hefei, Anhui, P.R. China Jun. 2000 Theoretical and Applied Mechanics (Fluid Mechanics)

Academic Experience

Assistant Professor, Mechanical & Aerospace Engineering, New Mexico State University, 2010-Present, full-time

Research Scientist, Mechanical & Aerospace Engineering, The George Washington University, Washington, DC, March 2009-July 2010

Postdoctoral Research Fellow, Biomedical Engineering, Carnegie Mellon University / Bioengineering, University of Pittsburgh, Pittsburgh, Pennsylvania, January 2006-February 2009

Non-academic experience

None

Certifications or professional registrations

None

Current membership in professional organizations

Member of American Physical Society

Life time member of American Institute of Aeronautics and Astronautics

Honors and awards

Nominated for Helmut Reul Young Investigator Award, Oct. 2008.

Frederick A. Environmental Award, Purdue University, August 2004

Service activities

In charge of one low-speed wind tunnel and one water channel.

Publications

A.L. Glenn, K.V. Bulusu, F. Shu and M.W. Plesniak, "Secondary Flow Structures Under Stent-Induced Perturbations for Cardiovascular Flow in a Curved Artery Model", accepted by *International Journal of Heat and Fluid Flow,* 2011

S. Vandenberghe, F. Shu, D.K. Arnold, J.F. Antaki, “A simple, Economical, and Effective Portable Pediatric Mock Circulatory System” *Proceedings of the Institution of Mechanical Engineers, Part H: Journal of Engineering in Medicine*, vol. 225, 7: pp. 648-656, July 2011

F. Shu, S. Vandenberghe and J. F. Antaki, “The Importance Of dQ/dt On The Flow Field In A Turbodynamic Pump With Pulsatile Flow”, *Artificial Organs*, vol. 33, No. 9, pp 757-762, September 2009

R.K. Gottlieb, F. Shu, Z. Wu, M.V. Kameneva, J.F. Antaki, Z.J. Wu and G.W. Burgreen “Liquid Crystal Shear Stress Sensor for Blood and Other Opaque Viscous Fluids”, *Journal of flow visualization and image processing*, vol. 16, issue 1, pp 51-71, 2009

F. Shu, R. Parks, J. Maholtz, S. Ash, and J. F. Antaki, “Multi-modal Flow Visualization and Optimization of Pneumatic Blood Pump for Sorbent Hemodialysis System”, *Artificial Organs*, vol 33, No. 4, pp 334-345, April 2009

R. Zhao , J.N. Marhefka, F. Shu, M.V. Kameneva and J.F. Antaki, “Micro-flow Visualization of Red Blood Cell Enhanced Platelet Concentration at Sudden Expansion,” *Annals of Biomedical Engineering*, vol. 36 No. 7, pp.1130-1141, July 2008

J. F. Antaki, C. Diao, F. Shu, J. Wu, R. Zhao and M. V. Kameneva, “Micro-hemodynamics within Blade Tip Clearance of a Centrifugal Turbodynamic Blood Pump,” *Proceedings of the Institution of Mechanical Engineers, Part H, Journal of Engineering in Medicine,* vol. 222, No. H4, pp.573-581, May 2008

F. Shu, M. W. Plesniak and P. E. Sojka, “Experimental Investigation of Flow Physics in Indeterminate Origin Nozzle Jet,” *Journal of Experimental Mechanics (China),* vol. 22, No. Z1, 2007

Name: Mark E Stevens

Education

BS Mechanical Engineering, NMSU 1990

Academic experience

NMSU Instructor – ME 102 Introduction to Engineering, 2011 - 2012, part time

Non-academic experience

9/06 to Present Staff Engineer Laboratories Department NASA/MEI, NASA White Sands Test Facility

12/04 to 9/2006 Lead Components Services Engineer NASA/Honeywell, NASA White Sands Test Fac.

6/01 to 12/2004 Contamination Control Manager-NASA/Honeywell NASA White Sands Test Facility

1/90 to 6/2001 Senior Site Component Engineer–AlliedSignal, NASA White Sands Test Facility

1/89 to 6/90 Project Assistant - ME Department, New Mexico State University

6/88 to 12/88 Engineering Assistant - FMC, San Jose, California

1/83 to 5/85 Mobile Equipment Maintenance Supervisor-Steamboat Ski Corporation, Colorado.

MILITARY

10/76 to 8/79 Naval Reserve Kirtland Air Force base

9/74 to 10/76 Aviation Anti-submarine Warfare Technician - United States Navy, Norfolk, Va

Certifications or professional registrations

6 sigma green belt

FAA Designated Manufacturing Inspection Representative

NASA Pressure system engineer

NASA Designer

NASA inspection Verifier

Current membership in professional organizations

None

Honors and awards

Bronze Bravo award for Propulsion 401 support – 12/16/2005

Silver Bravo award for Masoneilan design – 9/14/2005

ORCA project team recognition award – 7/25/2005
Elected member NMSU Mechanical Engineer Academy 2/2005
6 sigma green belt award 2005
Quality achiever award 2001
Quest for Excellence - Honeywell 5/18/2001
Silver Snoopy Award - NASA 1996
Sailor of the Month, July, 1976
Plane Captain of the Quarter, July, 1976
Citation for U.S. Service Ribbon, 1975
Eagle with Palm and Vigil Honor, 1974

Service Activities

Involved with Church and help people regularly

Publications and presentations

None

Professional development activities

FAA Designated Manufacturing Inspection Representative

1. **Name:** James F. Vennes

2. **Education**
   - B.S. (Surveying Engineering), New Mexico State University, 1997
   - B.S. (Engineering Technology – Electronics & Computers), New Mexico State University, 2001

3. **Academic Experience**
   - New Mexico State University, Mechanical & Aerospace Engineering, Las Cruces, NM (September 2002 – present) Senior Systems Analyst, Web Developer, & Instructor. Teaching 3D parametric modeling (ME 159 – Graphical Communications & Design).

   - New Mexico State University, Las Cruces, NM (1997-2001) College Professor – College of Engineering; -- Instruction included basic and intermediate computer skills (Word, Excel, Powerpoint, and HTML), CAD for Civil/Surveying Engineers, Linux Administration, and basic electronics.

4. **Non-Academic Experience**
   - IBM Server Group, Austin, TX (July 2001 – Aug 2002) Software Engineer, Programming, systems administration, and internal customer support with Design Systems Environment team serving over 500 design engineers and 2500+ computers in the world's largest batch submission computing environment.
   - IBM Microelectronics Division, Burlington, VT (Summer 2000) Engineering intern, developed algorithms for spatial density analysis of metal levels on integrated circuits.
   - National Science Foundation (NSF), Washington DC (Summer 1999) Engineering intern, Geographical Information Systems research and professional web development.

5. **Certifications or Professional Registrations**

None

6. **Professional Organizations**
   - New Mexico Professional Surveyors (NMPS)
   - American Congress on Surveying and Mapping (ACSM),
   - Regional Alliance of Science, Engineering, and Mathematics for Students with Disabilities (RASEM)

7. **Honors and Awards**
   - Ed and Harold Foreman Staff Excellence Award, 2012

8. **Service Activities**
   - Programming Mentor, 2011

9. Publications

None

10. Professional Development

- Microsoft Virtual Academy – Virtual Machine Management, 2012
- TrainSignal VMware vSphere 5 Training, 2011
- CBT Windows Server 2008 R2 Administration training course, 2010
- CBT Powershell for Administrators training course, 2009
- Symantec Disaster Recovery Strategies training course, 2006
- Lynda.com PERL Programming for Administrators, 2004

Name: Mingjun Wei

Education

Ph.D. Theor. and Applied Mechanics, University of Illinois at Urbana-Champaign, 2004

M.S. Mechanical Engineering, University of California, Los Angeles, 2001

M.Engr. Modern Mechanics, University of Science and Technology of China, 1998

B.S. Modern Mechanics, University of Science and Technology of China, 1996

Academic experience

Assistant Professor, Mechanical & Aerospace Engineering, New Mexico State University, 2006-present

Invited Researcher, 2nd European Forum on Flow Control, Poitiers, France, April-June, 2006

Postdoctoral Research Associate (Supervisor: Clarence W. Rowley), Mechanical & Aerospace Engineering Department, Princeton University, 2005-2006

Non-academic experience

None

Certifications or professional registrations

None

Current membership in professional organizations

American Institute of Aeronautics and Astronautics (AIAA) senior member

American Physical Society (APS) member

Honors and awards

None

Service activities

AIAA Aeroacoustics Technical Committee member: 2007-present

Conference session chair for AIAA Aerospace Sciences Meeting, AIAA Southwest Regional Technology Symposium, 61st APS-DFD annual meeting, AIAA Aerospace Sciences meeting and Exhibit.

Paper referee: Physics of Fluids, Journal of Computational Physics, AIAA Journal, International Journal for Numerical Methods in Engineering, Aeronautical Journal, Chinese Physics Letters, Papers for various academic conferences (AIAA, ASME)

Publications and presentations

A.V.G. Cavalieri, P. Jordan, Y. Gervais, M. Wei, and J.B. Freund, "Intermittent sound generation and its control in a free-shear flow", *Physics of Fluids*, Vol. 22, No. 15113, 2010.

T. Yang, M. Wei, and H. Zhao, "Numerical study of flexible flapping wing propulsion", *AIAA Journal*, Vol. 48, No. 12, pp. 2909-5912, 2010.

L. Zhou, Z. Wan, D. Sun, and M. Wei, The effects of initial perturbation to mixing-layer noise, Theoretical and Applied Mechanics Letters (in press), 2012

L. Zhou, M. Wei, and D. J. Sun, A simple model for mechanism study of sound generation in mixing layers, International Journal of Aeroacoustics (in press), 2012

M. Schlegel, B. R. Noack, P. Jordan, A. Dillmann, E. Gröschel, W. Schröder, M. Wei, J. B. Freund, O. Lehmann, and G. Tadmor, On least-order flow representations for aerodynamics and aeroacoustics, J. Fluid Mech., Vol. 697, pp. 367--398, 2012

M. Wei, B. R. Qawasmeh, M. Barone, B. G. van Bloemen Waanders, and L. Zhou, Low-dimensional model of spatial shear layers, Physics of Fluids, Vol. 24, No. 014108, 2012

B. N. Shashikanth, A. Sheshmani, S. Kelly, and M. Wei, Hamiltonian structure and dynamics of a neutrally buoyant rigid sphere interacting with thin vortex rings, Journal of Mathematical Fluid Mechanics , Vol. 12, pp. 335--353, 2010

C. Cai, K. R. Khasawneh, H. Liu, and M. Wei, Collisionless gas flows over a cylindrical or a spherical object, Journal of Spacecraft and Rockets, Vol. 46, No. 6, Nov.-Dec., 2009

J. D. Hooser, M. Wei, B. E. Newton, and G. J. A. Chiffoleau, An approach to understanding flow friction ignition: a computational fluid dynamics (CFD) study on temperature development of high-pressure oxygen flow inside micron-scale seal cracks, Journal of ASTM International, Vol. 6, No. 10, Nov. 2009

M. Wei, and C. W. Rowley, Low-dimensional models of a temporally evolving free shear layer, J. Fluid Mech., Vol. 618, pp. 113--134, 2009

Professional development activities

None

Department of Chemical Engineering – Faculty CVs

Paul K. Andersen, Ph.D.

Associate Professor Telephone: 575-646-8153
Department of Chemical Engineering Fax: 575-646-7706
New Mexico State University Email: pka@nmsu.edu
Las Cruces, NM 88003 Web: http://chemeng.nmsu.edu/che_faculty _pandersen.htm

Education

Ph.D. Chemical Engineering, University of California, Berkeley, CA (1987)
B.S. Chemical Engineering, Brigham Young University, Provo, UT(1981)

Academic Experience

New Mexico State University, Associate Professor (Chem. Eng.), (1997–Present), full time
Purdue University, Associate Professor (Freshman Engineering), (1987–1997), full time
Purdue University, Assistant Professor (Freshman Engineering), (2006-2009), full time

Non-Academic Experience

Bechtel Petroleum, Slurry Pipeline Group, San Francisco, CA (Summer 1980; June 1981 to January 1982).

International Business Machines, General Products Division, San Jose, CA (January to September 1979).

Certificates or Professional Registrations

None

Current Membership in Professional Organizations

American Institute of Chemical Engineers (AIChE)
American Chemical Society (ACS)

Honors and Awards

None

Service Activities

NMSU Faculty Senate
NMSU Advocates for Classroom Assessment Committee
NMSU Advocates for Scholarly Teaching Committee
Engineering Physics Advisory Committee
College of Engineering Education Committee

Publications, Presentations and Patents

Y. 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, 309–314.

S. 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.

S. 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.

S. 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.

A. 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.

A. 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.

P. K. Andersen (2005). *Just Enough UNIX*, 5th ed. New York: McGraw-Hill.

Recent Professional Development Activities

None

Shuguang Deng, Ph.D.

Bob Davis Professor Telephone: 575-646-4346
Department of Chemical Engineering Fax: 575-646-7706
New Mexico State University Email: sdeng@nmsu.edu
Las Cruces, NM 88003 Webpage: http://chemeng.nmsu.edu/che_faculty_sdeng.htm

Education

Ph.D. Chemical Engineering, University of Cincinnati, Cincinnati, Ohio (1996)
M.S. Chemical Engineering, Zhejiang University, Hangzhou, China (1987)
B.S. Chemical Engineering, Zhejiang University, Hangzhou, China (1984)

Academic Experience

New Mexico State University, Professor (Chem. Eng.), (2009- Present), full time
New Mexico State University, Associate Professor (Chem. Eng.), (2006-2009), full time
New Mexico State University, Assistant Professor (Chem. Eng.), (2003- 2006), full time

Non-Academic Experience

Layne Christensen Company, Bridgewater, NJ, Process Engineer, (1/2003-7/2003), full time

The BOC Group, Murray Hill, NJ, Lead Research Engineer, (1996-2002), full time
Nanjing Refinery, Nanjing, China, R&D Manager, (1987-1992), full time

Certificates or Professional Registrations

None

Current Membership in Professional Organizations

American Institute of Chemical Engineers (AIChE)
American Chemical Society (ACS)
International Adsorption Society (IAS)

Honors and Awards

Fulbright Distinguished Chair in Energy Conservation (2012)
University Research Distinguished Career Award, New Mexico State University (2011)
Millionaire Researcher, New Mexico State University (2010)
College of Engineering Distinguished Bromilow Excellence in Research Award, New Mexico State University (2009)
University Research Council's Award for Creative Scholarly Activity, New Mexico State University (2007)
Bob Davis Endowed Professorship, New Mexico State University (2005)
Innovation Excellence Award, The BOC Group (2001)

Innovation Achievement Award, The BOC Group (1999)

Service Activities

AIChE, ACS and IAS annual meeting session organizer/chair

Reviewer for ~20 scholarly journals and 4 funding agencies and foundations

Advisory/Editorial board of *J. Energy Science and Technology*; *Recent Patents on Chem. Eng.*; *J. Environ. Protection,*; *J. Chem. Eng. & Process Technology*

New Mexico State University College of Engineering promotion and tenure committee

Publications, Presentations and Patents

(Selected from 90^+ journal publications and 18 patents/applications, H=16)

- "Power dissipation in microwave-enhanced in-situ transesterification of algal biomass to biodiesel", Patil, P.D.; Reddy, R.; Muppaneni, T.; Schuab, T.; Lammers, P. Nirmalakhandan, N.; Cooke, P.; Deng, S., *Green Chemistry*, 14, 809-818 (2012).
- "Direct growth of graphene films on TEM nickel grids using benzene as precursor", Dai, G-P; Cooke, P.H.; Deng, S., *Chem. Phys. Lett*., 531, 193-196 (2012).
- "Non-catalytic transesterification of camelina oil under supercritical ethanol conditions" Muppaneni, T.; Reddy, H.K.; Patil, P.D.; Deng, S., *Applied Energy*, 94, 84-88 (2012).
- "Hydrogen Adsorption on Pd- and Ru-Doped C_{60} Fullerene at Ambient Temperature", Saha, D.; Deng, S., *Langmuir*, 27(11), 6780-6786 (2011).
- "Adsorption of CO_2 and CH_4 on a magnesium-based Metal-Organic Framework", Bao, Z.; Yu, L.; Ren, Q.; Lu, X.; Deng, S., *J. Colloid Interface Sci*., 353, 549–556 (2011).
- "Adsorption of ethane, ethylene, propane and propylene on a magnesium-based metal-organic framework", Bao, Z.; Alnemrat, S.; Yu, L.; Vasiliev, I.; Ren, Q.; Lu, X.; Deng, S., *Langmuir*, accepted (2011).
- "Adsorption of CO_2, CH_4, N_2O and N_2 on MOF-5, MOF-177 and Zeolite 5A" Saha, D.; Bao, Z.; Feng, J.; Deng, S., *Environ. Sci. Technol*., 44, 1820-1826 (2010).
- "Accelerated formation of THF-H_2 clathrate hydrate in porous media", Saha, D. and Deng, S., *Langmuir*, 26(11), 8414-8418 (2010).
- "Hydrogen adsorption on partially truncated and open cage C_{60} fullerene", Saha, D.; Deng, S., *Carbon*, 48, 3471-3476 (2010).
- "Hydrogen adsorption in ordered mesoporous carbon doped with Pt, Pd, Ru and Ni", Saha, D. and Deng S., *Langmuir*, 25(21), 12550-12560 (2009).
- "Adsorption of bacillus subtilis on carbon nanotube aggregates, activated carbon and NanoCeram™", Upadhyayula,V.K.K., Deng, S., Smith, G.B., and Mitchell, M.C., *Water Research*, 43, 148-156 (2009).
- "Optimization of biodiesel production from edible and non-edible vegetable oils" Patil, P., and Deng S., *Fuel*, 88, 1302-1306 (2009).

Recent Professional Development Activities

New Mexico State University ADVANCING Leaders Program (2011)

New Mexico State University Teaching Academy Mentoring Program (2003 - 2011)

Abbas Ghassemi, PhD

Professor of Chemical Engineering and Director Institute for Energy & the Environment (IEE)
Box 30001; Las Cruces, NM 88003-8001

Education

University of Oklahoma	Chemical Engineering	BS	1979
New Mexico State University	Chemical Engineering	MS	1989
New Mexico State University	Chemical Engineering	PhD	1991

Academic Experience

IEE- 2006-present	Professor and Director IEE
WERC- 1999-present	Executive Director WERC
WERC -1990-1999	Director of Research

Non-Academic Experience

Monsanto, Fisher Controls, Intl.1979 - 1988 Various senior management positions

Certificates or Professional Registrations

None

Current Membership in Professional Organizations

American Institute of Chemical Engineers (AIChE)

Honors and Awards

Dr. Ghassemi is the Director of Institute for Energy and Environment (IEE) and professor of Chemical Engineering at New Mexico State University. He oversees the operations of IEE and as the Director of IEE, he is the Chief Operating Officer for programs of over $7-million annually in education and research, and outreach in energy resources including renewable energy, water quality and quantity and environmental issues. He is responsible for administrative duties, operation, budget, planning, and personnel supervision for the program. Dr. Ghassemi has authored and edited several text books and has many publications and papers in the areas of energy, water, waste management, process control, thermodynamics, transport phenomena, education management and innovative teaching methods. His research areas of interest include risk-based decision making, renewable energy and water, energy efficiency and pollution prevention, multiphase flow and process control.

Service Activities

Dr. Ghassemi holds a BS, MS and PhD in Chemical Engineering with minors in mathematics and experimental statistics from University of Oklahoma and New Mexico State University respectively and serves on a number of public and private boards, editorial boards, and peer review panels.

PUBLICATIONS/BOOKS/JOURNALS

- Myint, Maung T, Ghassemi, A., and Nirmalakhandan, N. "Modeling in Desalination: Electro-dialysis Reversal." Desalination and Water Treatment 27 (2011) 255–267.

- Myint Maung T., Ghassemi A., and Nirmalakhanda N. “Low Energy Desalination: Low Dose & Low Mean Ion Resident Time in Concentrate of Electrodialysis Reversal”. Water Science and Technology 63(9) 1855-1863.

Books- 2009-2011:

Ghassemi, A. “Renewable Energy Series”, a 8 book series in solar, wind, geothermal, hydro, biomass and nuclear energy published by CRC Press.

http://www.crcpress.com/ecommerce_product/book_series.jsf?series_id=2268

Presentations- 2011:

- Hanrahan, C., Sharbatmaleki, M., Loya, J., Ghassemi, A., “Limiting Current Density in Pilot-scale Electrodialysis Reversal”, New Water New Energy Conference, Alamogordo, NM, Dec. 13-14, 2011.

- Karimi, L., Sharbatmaleki, M., Loya, J., Ghassemi, A., “Mathematical Models Explaining Ion Selectivity in Electro-separation Processes”, New Water New Energy Conference, Alamogordo, NM, Dec. 13-14, 2011.

- Rastegary, J., Ghassemi, A. “Conversion of Concentrate Stream to Food, Feed and Biofuel” 56th Annual New Mexico Water Conference, Alamogordo, New Mexico, Dec. 13-14, 2011.

- Abuhasel, K., Rastegary, J., Ghassemi, A. “Brackish Water as a New Medium to Maximize Biomass of Microalgae” 56th Annual New Mexico Water Conference, Alamogordo, New Mexico, Dec. 13-14, 2011.

Jessica P. Houston, Ph.D.

Assistant Professor Telephone: 575-646-5563
Department of Chemical Engineering Fax: 575-646-7706
New Mexico State University Email: jph@nmsu.edu
Las Cruces, NM 88003 Webpage: http://chemeng.nmsu.edu/che_faculty_jhouston.htm

Education

Ph.D. Chemical Engineering, Texas A&M University, College Station, Texas (2005)
M.S. Chemical Engineering, Texas A&M University, College Station, Texas (2002)
B.S. Chemical Engineering, New Mexico State University, Las Cruces, NM (1995)

Academic Experience

New Mexico State University, Assistant Professor (Chem. Eng.), (2009- present), full time

Non-Academic Experience

Los Alamos National Laboratory, Los Alamos, New Mexico, Director's Postdoctoral Fellow, (2006-2009), full time
Baylor College of Medicine, Houston, Texas, Research Associate (2005-2006), full time

Certificates or Professional Registrations

None

Current Membership in Professional Organizations

American Institute of Chemical Engineers (AIChE)
International Society for the Advancement of Cytometry (ISAC)
Optical Society of America (OSA)

Honors and Awards

Research Achievement Award, NMSU Office of the Vice President for Research (2011)
Outstanding Junior Faculty Award, NMSU Hispanic Faculty and Staff Caucus (2011)
Dean's Recognition Award, NMSU College of Engineering (2010)
Sony Junior Faculty Scholarship Award, Sony Corp (2009)

Service Activities

AIChE, meeting session organizer/chair
Reviewer for 4 scholarly journals and 2 funding agencies

Publications, Presentations and Patents

J. P. Houston, M. Naivar, P. Jenkins, and J. P. Freyer, “Detection of fluorescence decay times by flow cytometry,” *Current Protocols in flow cytometry*, in press, 2012

J. P. Houston, M. Naivar, and J. P. Freyer, “Digital Acquisition of fluorescence lifetime by frequency domain flow cytometry,” *Cytometry Part A*, 2010, **77A(9):**861- 872.

E. M. Sevick-Muraca, R. Sharma, J. C. Rasmussen, M. V. Marshall, J. A.Wendt, H. Q. Pham, E. Bonefas, J. P. Houston, L. Sampath, K. E. Adams, D. Blanchard, R.E. Fisher, S. Chiang, R. Elledge, and M. E. Mawad, “Imaging of lymph flow in breast cancer patients after microdose administration of a near-infrared fluorophore – feasibility,” *Radiology* 2008, **246(3)** 734-741.

R. Sharma, W. Wang, J. Rasmussen, A. Joshi, J. P. Houston, K. Adams, A. Cameron, S. Ke, M. Mawad, and E. Sevick, “Quantitative imaging of lymph function,” *American Journal of Physiology: Heart and Circulation* 2007, **292**:H3109-H3118.

J. P. Houston, S. Ke, W. Wang, C. Li, and E. M. Sevick-Muraca, “Quality analysis of *in vivo* NIR fluorescence and conventional gamma images acquired using a dual-labeled tumor-targeting probe,” *Journal of Biomedical Optics* 2005, **10**(5):54010.

K. Hwang**,** J. P. Houston**,** J. Rasmussen, S. Ke, C. Li, and E. M. Sevick-Muraca, “Enhanced fluorescent optical imaging with improved excitation light rejection,” *Molecular Imaging* 2005, **4**(3):194-204.

S. Kwon, S. Ke, J. P. Houston, W. Wang, Q. Wu, C. Li, and E. M. Sevick-Muraca, “Imaging dose-dependent pharmacokinetics of an RGD-fluorescent dye conjugate targeted to avb3 receptor expressed in Kaposi’s sarcoma,” *Molecular Imaging* 2005, **4**:75-87 (*cover of issue*).

C.Li, W. Wang, Q. Wu, S. Ke, J. P. Houston, E. M. Sevick-Muraca, L. Dong, D. Chow, C. Charnsangavej and J. P. Gelovani, "Dual optical and nuclear imaging in human melanoma xenografts using a single targeted imaging probe,” *Nuclear Medicine and Biology* 2006, **33**(3):349-358.

J. P. Houston and E. M. Sevick-Muraca, “Sensitivity and depth penetration of CW versus FDPM NIR fluorescence contrast-enhanced imaging,” *Photochemistry and Photobiology* 2003, **77**:420-430.

Recent Professional Development Activities

- New Mexico State University Teaching Academy Peer Coaching Program (2011)
- New Mexico State University Teaching Academy ADVANCE Mentoring Program (2009 - 2011)
- New Mexico State University Teaching Academy Team Mentoring Program (2009 - 2010)

Hongmei Luo, Ph.D.

Assistant Professor Telephone: 575-646-4204
Department of Chemical Engineering Fax: 575-646-7706
New Mexico State University Email: hluo@nmsu.edu
Las Cruces, NM 88003 Webpage: http://chemeng.nmsu.edu/che_faculty_hluo.htm

Education

Ph.D. Chemical Engineering, Tulane University, New Orleans, LA (2006)
M.S. Materials Science and Engineering, University of Science and Technology of China (1995)
B.S. Chemistry, Fuyang Normal University, Fuyang, China (1992)

Academic Experience

New Mexico State University, Assistant Professor (Chem. Eng.), (2009 - Present), full time
Los Alamos National Laboratory, Postdoctoral Associate (Materials Physics and Applications Division), (2006 - 2009), full time

Non-Academic Experience

None

Certificates or Professional Registrations

None

Current Membership in Professional Organizations

American Institute of Chemical Engineers (AIChE)
Materials Research Society (MRS)
American Ceramic Society (ACerS)
American Society for Engineering Education (ASEE)

Honors and Awards

Research Accomplishment Award, Superconducting Technology Center, Los Alamos (2009)
Research Accomplishment Award, Superconducting Technology Center, Los Alamos (2008)
Keli Award, Nanjing University (2000)
President Award, Chinese Academy of Sciences (1997)

Service Activities

AIChE annual meeting session chair
Committee member on Awards & Scholarships, ACerS Division of Electronic Ceramics
Reviewer for 15+ scholarly journals and 2 funding agencies (NSF, ACS)
Editorial Board: International Journal of Micro and Nano Electronics, Circuits and Systems
Guest Editor for special topic “Nanocomposite” in Journal of Nanotechnology
Graduate Student Coordinator, Department of Chemical Engineering, NMSU
User/Advisory group member in Core University Research Resources Laboratory, NMSU

Publications, Presentations and Patents

(Selected from 84 journal publications, 79 presentation, and 4 patents/applications, H=14)

- Xu, Y.; Yi, R.; Yuan, B.; Wu, X.; Dunwell, M.; Lin, Q.; Fei, L.; Deng, S.; Andersen, P.; Wang, D.; Luo, H. M. "High capacity MoO_2/graphite oxide composite anode for lithium ion batteries" *J. Phys. Chem. Lett.* 3, 309-314 (2012).
- Baber, S.; Lin, Q.; Zou, G.; Haberkorn, N.; Baily, S. A.; Wang, H.; Bi, Z.; Yang, H.; Deng, S.; Hawley, M. E.; Civale, L. Luo, H. M. "Magnetic properties of self-assembled epitaxial nanocomposite $CoFe_2O_4$:$SrTiO_3$ and $CoFe_2O_4$:MgO films", *J. Phys. Chem. C* 115, 25338 (2011).
- Luo, H. M.; Zou, G.; Wang, H.; Lee, J. H.; Lin, Y.; Peng, H.; Lin, Q.; Deng, S.; Bauer, E.; McCleskey, T. M.; Burrell, A. K.; Jia, Q. X. "Controlloing crystal structure and oxidation state in metal-nitrides through epitaxial stabilization", *J. Phys. Chem. C* 115, 17880 (2011).
- Zou, G.; Luo, H. M.; Baily, S.; Zhang, Y.; Haberkorn, N.; Xiong, J.; Bauer, E.; McCleskey, T. M,; Burrell, A. K.; Civale, L.; Zhu, Y. T.; Macmanus-driscoll, J. L.; Jia, Q. X. "Highly aligned carbon nanotube forests coated by superconducting NbC", *Nature Commun.* 1438 (2011).
- Bi, Z.; Weal, E.; Luo, H. M.; Chen, A.; Macmanus-driscoll, J. L.; Jia, Q. X.; Wang, H.; "Microstructural and magnetic properties of $(La_{0.7}Sr_{0.3}MnO_3)_{0.7}$:$(Mn_3O_4)_{0.3}$ nanocomposite thin films", *J. Appl. Phys.* 109, 054302 (2011).
- Luo, H. M.; Wang, H.; Zou, G.; Bauer, E.; McCleskey, T. M.; Burrell, A. K.; Jia, Q. X. "Review: epitaxial metal-nitride thin films by polymer-assisted deposition", (invited review) *Trans. Electri. Electron. Mater.*,11, 54-60 (2010).
- Zou, G.; Luo, H. M.; Ronning, F.; Sun, B. Q.; McCleskey, T. M.; Burrell, A. K.; Bauer, E.; Jia, Q. X. "A facile chemical solution deposition to high mobility epitaxial Ge films on Si", *Angew. Chemie. Int. Ed.* 49, 1782-1785 (2010).
- Zou, G.; Luo, H. M.; Zhang, Y.; Xiong, J.; Wei, Q. M.; Zhuo, M. J.; Zhai, J. Y.; McCleskey, T. M.; Burrell, A. K.; Jia, Q. X. "A chemical solution approach for superconducting and hard epitaxial NbC film", *Chem. Commun.* 46, 7837 (2010).
- Zou, G.; Wang, H.; Mara, N.; Luo, H. M.; Li, N.; Di, Z.; Bauer, E.; McCleskey, T. M.; Burrell, A. K.; Jia, Q. X. "Chemical solution deposition of epitaxial carbide films", *J. Am. Chem. Soc.* 132, 2516 (2010).
- Baber, S.; Zhou, M.; Lin, Q.; Naala, M.; Lu Y.; Luo, H. M. "Nanoconfined surfactant template electrodeposition to porous hierarchical nanowires and nanotubes", *Nanotechnol*. 21, 165603 (2010).
- Luo, H. M.; Lin, Q.; Baber, S.; Naalla, M. "Surfactant template mesoporous metal oxide nanowires", *J. Nanomater*. 750960_1-6 (2010).
- Luo, H. M.; Wang, H.; Bi, Z. X.; Zou, G. F.; McCleskey, T. M.; Burrell, A. K.; Bauer, E.; Hawley, M. E.; Wang, Y.; Jia, Q. X. "Highly conductive layered ternary transition metal-nitride films", *Angew. Chemie. Int. Ed.*, 48, 1490-1493 (2009).

Recent Professional Development Activities

New Mexico State University Teaching Academy Mentoring Program (2009 - present)

Martha C. Mitchell, Ph.D., P.E.

Associate Dean for Research
College of Engineering
New Mexico State University
Las Cruces, NM 88003

Telephone: 575-646-3422
Fax: 575-646-7706
Email: martmitc@nmsu.edu

Education

Ph.D. Chemical Engineering, University of Minnesota-Minneapolis (1996)
B.S. Chemical Engineering, University of Wisconsin-Madison (1989)

Academic Experience

New Mexico State University, Assoc. Dean for Research (Eng.), (201- Present), full time
New Mexico State University, Acad. Dept. Head (Chem. Eng.), (2005- 2011), full time
New Mexico State University, Professor (Chem. Eng.), (2007- Present), full time
New Mexico State University, Associate Professor (Chem. Eng.), (2002-2007), full time
New Mexico State University, Assistant Professor (Chem. Eng.), (1996- 2002), full time

Non-Academic Experience

Visiting Summer Faculty, Sandia National Labs, Albuquerque, NM. Summer 2001, full time
Visiting Professional, Exxon Research and Eng., Annandale, NJ. Summer 1997, full time

Certificates or Professional Registrations

Professional Engineer, New Mexico #15571

Current Membership in Professional Organizations

American Institute of Chemical Engineers (AIChE)
American Chemical Society (ACS)
American Society of Engineering Education (ASEE)
Society for Women in Engineering (SWE)

Honors and Awards

Bob Davis Endowed Professorship, New Mexico State University (2008-2011)

Service Activities

ABET EAC evaluator
NSF panel reviewer
AIChE, ACS annual meeting session organizer/chair
New Mexico State Research and Economic Development Committee (2011)
NMSU Department Heads Academy Steering Committee (2010-present)
NMSU Teaching Academy Advisory Board (2011-present)

Publications, Presentations and Patents

- Upadhyayula,V.K.K., Deng, S., Smith, G.B., and Mitchell, M.C., "Adsorption of Bacillus subtilis on Carbon Nanotube Aggregates, Activated Carbon and NanoCeram^{TM}," *Water Research*, 43, 148-156 (2009).

- Upadhyayula, V.K.K., Ghoshroy, S., Nair, V.K., Smith, G.B., Mitchell, M.C., and Deng, S., "Single–Walled Carbon Nanotubes as Fluorescence Biosensors for Pathogen Recognition in Water Systems" *Res. Lett. Nanotechnology*, Volume 2008, Article ID 156358, 5 pages, doi:10.1155 (2008).

- Upadhyayula, V.K.K., Deng, S., Mitchell, M.C., Nair, V.K., Smith, G.B., and Ghoshroy, S., "Adsorption kinetics of *Escherichia coli* and *Staphylococcus aureus* on single-walled carbon nanotube aggregates" *Water Science & Technology* 58(1), 179-184 (2008).

- Mitchell, M.C., Rakoff, R.W., Jobe, T.O., Sanchez, D.L., and Wilson, D.B., "Thermodynamic Analysis of Equations of State for the Monopropellant Hydrazine," (2007) *Journal of Thermophysics and Heat Transfer*, 21: 243-247.

- Mitchell, M.C., Upadhyayula, V.K.K. and Deng, S. (2008) "Adsorption of Microorganisms on Single-Walled Carbon Nanotubes and Other Porous Media" *Spring AIChE meeting, New Orleans, LA.*

- Deng, S., Upadhyayula V. K. K, Smith, G.B. and Mitchell, M.C., (2007) " Microscopic Analysis of Adsorption of E. coli and Staphylococcus aureus on Carbon Nanotubes," *AIChE Annual Meeting, Salt Lake City, Utah, Nov. 4-9.*

- Deng, S.,G., Upadhyayula, V.K.K., Smith, G.B. and Mitchell, M.C., (2007) "Adsorption Equilibrium and Kinetics of E. coli and Staphylococcus aureus on Carbon Nanotubes" *9th International Conferences on Fundamentals of Adsorption, Sicily, Italy, May 20-25.*

Recent Professional Development Activities

Women in Engineering at New Mexico State University (2009, 2010)
Women in STEM lunch group (2009-2011)
NM Partnerships for Adaptation, Implementation and Dissemination (2009-2011)
New Mexico State University Department Head's Academy (2009-2012)

- Academic Integrity
- Department Head's book discussion

New Mexico State University ADVANCING Leaders Program mentor (2009-2012)
New Mexico State University Teaching Academy Mentoring Program (2006 - 2012)

David A. Rockstraw, Ph. D., P. E.

Distinguished Achievement Professor Telephone: 575-646-7706
Department of Chemical Engineering Fax: 575-646-7706
New Mexico State University Email: drockstr@nmsu.edu
Las Cruces, NM 88003 Webpage: http://chemeng.nmsu.edu/

Education

Ph.D.	Chemical Engineering, The University of Oklahoma	(1989)
B.S.	Chemical Engineering; Purdue University	(1986)

Academic Experience

New Mexico State University, Distinguished Achievement Professor, Chemical Engineering	(2012-present)
New Mexico State University, Professor Chemical Engineering	(2004-2012)
New Mexico State University, Associate Professor Chemical Engineering	(1998-2004),
New Mexico State University, Assistant Professor Chemical Engineering	(1995- 1998)

Non-Academic Experience

Rockstraw Consulting, Mesilla, NM; Design Consultant and Expert Witness, 1997-present

Los Alamos National Laboratory, Los Alamos, NM; Visiting Scientist- Nuclear Materials Technology Division; 1997 – 2000 (summers).

E.I. DuPont de Nemours Co., Inc. / Conoco, Inc., Ponca City, OK; Research Engineer in Corporate Process Development; 8/90 – 7/95.

Ethyl Corp., Orangeburg, SC; Senior R&D Engineer, Research & Development; 9/89 – 7/90.

Kraft, Inc., Glenview, IL; Engineer I / Co-op Student - R&D Division; 8/81 – 8/86.

Certificates or Professional Registrations

Professional Engineer, NM

Current Membership in Professional Organizations

National Society of Professional Engineers
- 2010-11 Past Chair, Professional Engineers in Higher Education Interest Group

American Institute of Chemical Engineers
- Faculty Advisor to the NMSU Student AICh E Chapter, 2007-present

Honors and Awards

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
Research Grand Prize, American Academy Environmental Engineers, 1998

Service Activities

Reviewer for ~20 scholarly journals and 8 funding agencies and foundations
Chair, NMSU College of Engineering Mentoring Committee, 2010-present
Chair, Chemical Engineering Faculty Search Committee
Search Committee, NMSU Carlsbad Environmental Monitoring & Research Center
New Mexico State University College of Engineering promotion and tenure committee

Publications, Presentations and Patents

Old Dead Guy Trading Cards, D. A. Rockstraw, *Chemical Engineering Education*, **46**(1), Winter 2012.

Continuing Our Journey to Bridge the Process Safety Gaps Between Academia and Industry (Paper 232e), B. K. Vaughen, T. O. Spicer, D. Morrison, J. A. Klein, and D. A. Rockstraw, American Institute of Chemical Engineers Conference, Minneapolis, MN, Oct. 16-21, 2011.

Recruiting & Interacting with Students; Erin Reyes (NSPE), D. A. Rockstraw (NMSU), and T. Glunt (FDOT), NSPE Leadership Webinar Series, Nov. 11, 2010.

Effect of Ammonium Nitrate on Nanoparticle Size Reduction, K. C. Pingali, S. Deng, D. A. Rockstraw; *Research Letters in Nanotechnology,* Vol. 2008, Article ID 756843, doi:10.1155/2008/756843.

Direct Synthesis of Ru-Ni Core-Shell Nanoparticles by Spray-Pyrolysis: Effects of Temperature and Precursor Constituent Ratio, K. C. Pingali, S. Deng, D. A. Rockstraw; *Powder Technology*, 183(2), p.282-289 (2008).

Physicochemical properties of carbons prepared from pecan shell by phosphoric acid activation, Y. Guo and D. A. Rockstraw, *Bioresource Technology*; 98(8), 1513-1521. (May 2007).

Activated carbons prepared from rice hull by one-step phosphoric acid activation, Y. Guo and D. A. Rockstraw, *Microporous & Mesoporous Materials*, 100(1-3); 12-19, March 23, 2007.

Physical and chemical properties of carbons synthesized from xylan, cellulose, and Kraft lignin by H3PO4 activation, Y. Guo, D. A. Rockstraw, *Carbon*, 44(8); 1464-1475 (July 2006).

Recent Professional Development Activities

How to Meet New ABET Requirements on Hazard Management - SACHE Workshop based on interactive modules developed by CCPS
Aspen Tech training, June 2012 – Distillation Modeling and Process Economic Analyzer
Courses in accounting through the NMSU College of Business (ACCT 301, 302, 452)

M. Ginger Scarbrough, Ph.D.

College Associate Professor
Department of Chemical Engineering
New Mexico State University
Las Cruces, NM 88003

Telephone: 575-646-5466
Fax: 575-646-7706
Email: gscarbro@nmsu.edu

Education:

Ph.D. Structural Geology, Purdue University, 1992
B.S. Geophysics, University of Texas at El Paso, 1984

Academic Experience

New Mexico State University, College Assoc. Professor, Chemical Engineering, 2011 Present**,**
Materials Engineering
Baking Science and Technology,

New Mexico State University, College Assist. Professor, Chemical Engineering, 2000-2011,
Materials Engineering

Purdue University, Visiting Assistant Professor, Department of Computer Science, 1994-1996
Numerical Methods
C Programming for Scientists and Engineers
FORTRAN 90 Programming for Scientists and Engineers
FORTRAN 90 Programming for Business Majors

Purdue University, Instructor, Department of Freshman Engineering, Purdue University
Introduction to C Programming and Spreadsheets

Ball State University, Assistant Professor of Geology, 1991-1992
Structural Geology, Physical Geology, Field Methods in Geology

Non-Academic Experience

Freelance Technical and Copy, McGraw-Hill Higher Education
Title: Paul K. Andersen. *Just Enough UNIX (*Third, Fourth, and Fifth Editions)
(2000, 2003, 2006)

Science Item Writer, The American College Testing Service (ACT), 1990

Publications, Presentations, and Patents

P. K. Andersen, G. Bjedov, and M. G. Scarbrough. *Essential C: An Introduction for Scientists and Engineers*. Oxford University Press. 1995.

T. M. Tharp and M. Ginger Scarbrough. Application of hyperbolic stress-strain models for sandstone and shale to fold wavelength in the Mexican Ridges Foldbelt. *Journal of Structural Geology* 16(12): 1603-1618, 1994.

Kenneth R. White, P.E., Ph.D.

Interim Head, Chemical Engineering
Box 30001, MSC 3CE
New Mexico State University
Las Cruces, New Mexico 88003

Phone: 505-646-1214
Fax: 505-646-7706
E-mail: krwhite@nmsu.edu
Webpage: http://chemeng.nmsu.edu/che

Education

Ph.D.	Texas Tech University, Lubbock, Texas (1970)
M.S.C.E.	Texas Tech University, Lubbock, Texas (1966)
B.S.C.E.	Texas Tech University, Lubbock, Texas (1964)

Academic Experience

Interim Department Head, Chemical Engineering, New Mexico State University (2012)
Regents Professor Emeritus (2009-2011)
Interim Dean, College of Engineering, New Mexico State University, Las Cruces, New Mexico (2008-2009)
Regents Professor Emeritus (2007-2008)
Department Head, Civil Engineering, New Mexico State University, Las Cruces, New Mexico (2003-2007)
Interim Dean, College of Engineering, New Mexico State University, Las Cruces, New Mexico (2002-2003)
Department Head, Civil Engineering, New Mexico State University, Las Cruces, New Mexico (1988-2002)
Director, Engineering Research Center; Professor of Civil Engineering, New Mexico State University, Las Cruces, New Mexico (1984-1988)
Professor of Civil Engineering, New Mexico State University, Las Cruces, New Mexico (1980-1984)
1975-1980 Associate Professor of Civil Engineering, New Mexico State University, Las Cruces, New Mexico
Assistant Professor of Civil Engineering, New Mexico State University, Las Cruces, New Mexico (1970-1975)
Instructor, Texas Tech University, Lubbock, Texas (1966-1970)

Non-Academic Experience

Consultant to New Mexico Department of Transportation on the Testing and Evaluation of Bridges; Investigation of Soils, Foundations and Earth Slide Problems; Inspection of Complex or Critical Bridges; and Evaluation of Pavements and Pavement Management (1974-2007)
Consultant to New Mexico Department of Transportation on bridge capacity rating and training of bridge inspectors. (1972-1973)
Design Engineer, General Dynamics/Ft. Worth, Texas (1964-1965)

Certification or Professional Registration

Registered Professional Engineer

Current Membership in Professional Organizations

New Mexico State Transportation Commission (NMSTC)
American Society of Civil Engineers (ASCE)
National Society of Professional Engineers (NSPE)
American Society for Engineering Education (ASEE)

Honors and Awards

Regents Professor, New Mexico State University (2004)
Distinguished Service Award with Special Commendation, National Council of Examiners for Engineers and Surveyors (2005)
Certificate of Appreciation for service as Western Zone Vice President, National Council of Examiners for Engineers and Surveyors (2002-2004)
Appreciation Award for leadership in the Transportation Engineering Conference (2004)
Leadership in Transportation Research and Development, New Mexico State Highway and Transportation Dept. (2000)
National Council of Examiners for Engineers and Surveyors, Distinguished Service Award (1999)
Ingeniero Veterno De Nuevo Mexico, Life Time Service Award, New Mexico Society of Professional Engineers (1996)
Transportation Award for Excellence in Research by a Public Member, Alliance for Transportation Research (1994)
Bromilow Award for Research, College of Engineering (1983)
Certificate of Appreciation for President of the New Mexico Section, American Society of Civil Engineering (1984)

Service Activities

New Mexico State Transportation Commission; Secretary
New Mexico State Board of Registration for Professional Engineers and Surveyors; Past-Chairman
National Council of Examiners for Engineers and Surveyors, Board of Directors, Past Chair of Committee on Examinations for Professional Engineers and Past Chair of Civil Engineering Subcommittee

Principal Publications (Selected from 50+ journal and peer-reviewed publications)

LeFevre, W., Steadman, J.W., Tietjen, J.S., White, K.R., and Whitman, D.L., "Using the Fundamentals of Engineering (FE) Examination to Assess Academic Programs," National Council of Examiners for Engineers and Surveyors, Clemson, S.C., August 2005.
Jiang, R., White, K.R., and Albright, D.P., "Development of Integrated Transportation (ITD) Design," Transportation Research Board, Washington, D.C., January 2005.
Jiang, R., Jauregui, D.V., and White, K.R., "Review of Close-Range Photogrammetry Application in Bridge Engineering," Transportation Research Board, Washington, D.C., January 2005.
Jauregui, D.V., White, K.R., Pate, J.W., and Woodward, C.B., "Documentation of Bridge Inspection Projects Using Virtual Reality Approach," Journal of Infrastructure Systems, American Society of Civil Engineers, September 2005.
Jáuregui, D. V. and White, K. R. "Virtual Reality and Photogrammetry." *Inspection and Monitoring Techniques for Bridges and Civil Structures*, (Book Chapter) edited by Gongkang Fu, Woodhead Publishing Limited, Cambridge, UK, 2005.

Department of Electrical Engineering – Faculty CVs

NAME:

Deva K. Borah

EDUCATION:

Bachelor of Engineering, Electronics and Communications Engineering, Indian Institute of Science, Bangalore, India 1987

Master of Engineering, Electrical Communication Engineering, Indian Institute of Science, Bangalore, India 1992

Doctor of Philosophy, Research School of Information Sciences and Engineering, Australian National University, Canberra, Australia 2000

ACADEMIC EXPERIENCE:

New Mexico State University, Associate Professor with Tenure, full-time 2006-present

New Mexico State University, Assistant Professor, full-time 1999-2006

NON-ACADEMIC EXPERIENCE:

Indian Telephone Industries, Bangalore, India, Trainee 1987

CONSULTING, PATENTS, ETC.:

US Patents: US 7720012 Speaker identification in the presence of packet losses 2010

PROFESSIONAL REGISTRATION:

None

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:

Senior Member, Institute of Electrical and Electronics Engineers (IEEE)

HONORS & AWARDS:

Alumni Medal, Indian Institute of Science, Bangalore, India for being adjudged the best B.E. student in the Electrical Communication Engineering Department, 1987

INSTITUTIONAL AND PROFESSIONAL SERVICE IN THE LAST 5 YEARS:

Guest Editor, Eurasip Journal on Wireless Communications and Networking, 2009-2010

Member, Technical Program Committee, IEEE Globecom 2011, ChinaCom 2009, IEEE ICC 2007, IEEE WCNC 2006

NSF Panel Review Member, 2007, 2010

Reviewer, IEEE Transactions on Wireless Communications, IEEE Transactions on Signal Processing, IEEE Signal Processing Letters, IEEE J. Selected Areas on Communications

External PhD examiner, University of New South Wales, Australian National University

PRINCIPAL PUBLICATIONS/PRESENTATIONS IN THE LAST FIVE YEARS:

D. K. Borah and D. G. Voelz, "Spatially Partially Coherent Beam Parameter Optimization for Free Space Optical Communications," Optics Express **18**, 20746-20758 (2010)

H. Tapse and D. K. Borah, "Hybrid Optical/RF Channels: Characterization and Performance Study using Low Density Parity Check Codes," IEEE Transactions on Communications **57**, 3288-3297 (2009)

S. Nammi and D. K. Borah, "A List-Based Detection Technique for Long Intersymbol Interference Channels," IEEE Transactions on Wireless Communications **8**, 1276-1283 (2009)

D. K. Borah and D. G. Voelz, "Pointing Error Effects on Free Space Optical Communication Links in the Presence of Atmospheric Turbulence," IEEE/OSA J. Lightwave Technology **27**, 3965-3973 (2009)

R. Luna, D. K. Borah, R. Jonnalagadda and D. G. Voelz, "Experimental Demonstration of a Hybrid Link for Mitigating Atmospheric Turbulence Effects in Free Space Optical Communications," IEEE Photonics Technology Letters **21**, 1196-1198 (2009)

S. Basu, D. G. Voelz and D. K. Borah, "Fade statistics of a ground to satellite optical link in the presence of lead-ahead and aperture mismatch," Applied Optics **48**, 1274-1287 (2009)

S. -Y. Cho and D. K. Borah, "Chip-scale hybrid optical sensing systems using digital signal processing," Optics Express **17**, 150-155 (2009)

D. K. Borah, "Estimation of Frequency-Selective CDMA Channels with Large Possible Delay and Doppler Spreads," IEEE Transactions on Vehicular Technology **55**, 1126-1136 (2006)

COURSES TAUGHT 2009-2010:

EE 210, Engineering Analysis I

EE 496, Introduction to Communication Systems I

EE 497, Introduction to Communication Systems II

EE 571, Random Signal Analysis

EE 581, Digital Communications I

EE 583, Personal Communication Systems

PROFESSIONAL DEVELOPMENT ACTIVITIES IN THE LAST 5 YEARS:

International conferences on communications and signal processing attended: 2

Workshops and seminars attended at NMSU: 3

NAME:

Laura E. Boucheron

EDUCATION:

Bachelor of Science in Electrical Engineering, New Mexico State University, Las Cruces, NM, 2001

Master of Science in Electrical Engineering, New Mexico State University, Las Cruces, NM, 2003

Doctor of Philosophy in Electrical and Computer Engineering, University of California Santa Barbara, Santa Barbara, CA, 2008

ACADEMIC EXPERIENCE:

NMSU, Research Assistant Professor, Full-time 2010

NMSU, Postdoctoral Research Fellow, Full-time 2008-2010

NON-ACADEMIC EXPERIENCE:

Los Alamos National Laboratory, Grad. Research Asst., Full-time 2005-2007

CONSULTING, PATENTS, ETC.:

None

PROFESSIONAL REGISTRATION:

None

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:

IEEE

HONORS & AWARDS:

None

INSTITUTIONAL AND PROFESSIONAL SERVICE IN THE LAST 5 YEARS:

None

PRINCIPAL PUBLICATIONS/PRESENTATIONS IN THE LAST FIVE YEARS:

L. E. Boucheron, P. L. De Leon, and S. Sandoval, “Hybrid Scale/Vector Quantization of Mel-Frequency Cepstral Coefficients for Low Bit-Rate Coding of Speech,” To appear: *Data Compression Conference*, Mar. 2011

L. E. Boucheron, B. S. Manjunath, and N. R. Harvey, "Classification of breast cancer imagery using imperfectly segmented nuclei," In proceedings: *IEEE International Conference on Acoustics, Speech, and Signal Processing*, pp. 666-669, Mar. 2010

M. N. Gurcan, L. E. Boucheron, A. Can, A. Madabhushi, N. M. Rajpoot, B. Yener, "Histopathological image analysis: A review," *IEEE Reviews in Biomedical* Engineering, vol. 2, 147-171, 2009

L. E. Boucheron and P. L. De Leon, "On the inversion of mel-frequency cepstral coefficients for speech enhancement applications," In Proceedings: *IEEE International Conference on Signals and Electronic Systems*, pp. 485-488, Sep. 2008

L. E. Boucheron, N. R. Harvey, and B. S. Manjunath, "A quantitative object-level metric for segmentation performance and its application to cell nuclei," In Proceedings: *International Symposium on Visual Computing*, Lecture Notes in Computer Science, vol. 4841, pp. 208-219, Nov. 2007

L. E. Boucheron, Z. Bi, N. R. Harvey, B. S. Manjunath, and D. L. Rimm, "Utility of multispectral imaging for classification of routine clinical histopathology imagery," *BMC Cell Biology*, 8(Suppl 1):S8, (10 July 2007)

COURSES TAUGHT 2009–2010:

EE 418/419 Senior Capstone Design

PROFESSIONAL DEVELOPMENT ACTIVITIES IN THE LAST 5 YEARS:

Attended talks at ICASSP 2010

Attended Teaching Academy seminars

Reviewed manuscripts for journals and conferences

NAME

Sukumar Brahma

EDUCATION

Ph. D. in Electrical Engineering, Clemson University, Clemson, August 2003, Master of Technology, Electrical Engineering, Indian Institute of Technology, Bombay, 1997.

Bachelor of Engineering, Electrical Engineering, Gujarat University, Ahmedabad, India, 1989.

ACADEMIC EXPERIENCE

Tenure-track Assistant Professor, Klipsch School of Electrical & Computer Engineering, New Mexico State University, July 2007 – Present

Tenure-track Assistant Professor, Department of Electrical Engineering, Widener University, September 2003 – June 2007

Lecturer, Dept. of Electrical Engineering, B.V.M College of Engineering, Sardar Patel University, Gujarat, India, December 1990 – August 1999

NON-ACADEMIC EXPERIENCE

Assistant Engineer, Ahmedabad Electricity Company, Ahmedabad, India, September 1990 – December 1990

Trainee, Ahmedabad Electricity Company, Ahmedabad, India, August 1989 – August 1990

CONSULTING, PATENTS, ETC.

Consultant, Sandia National Laboratories, 2010

Consultant, Schlumberger, 2011

US Patent: S. M. Brahma, P. De Leon, R. Kavasseri, "Eliminating the Use of Anti-Aliasing Filters in Digital Relays by Oversampling" – US Patent approved in March 2011 – number to be assigned

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS

Member, *Sigma-Xi*, The Scientific Research Society

Senior Member, IEEE, Member IEEE Power and Energy Society (PES)

Member, IEEE PES Power and Energy Education Committee (PEEC)

Member, PES Power System Analysis, Computing and Economics Committee (PSACE)

INSTITUTIONAL AND PROFESSIONAL SERVICE (last 5 years)

Chair, LLLSC - Lifelong Learning Subcommittee of the PEEC

Chair, Distribution System Analysis Subcommittee of the PSACE three short courses taught at IEEE PES conferences

four sessions chaired at IEEE PES conferences

reviewed papers for IEEE Trans. Power Delivery, IEEE Trans. Power Systems, Int. J. of Emerging Electric Power Systems (IJEEPS), IEEE PES conferences.

Proposal Review for National Science Foundation

PRINCIPAL PUBLICATIONS (last 5 years)

Sravan K. Buggaveeti, Sukumar Brahma, Improved Overcurrent Protection of Capacitor Banks Using Mathematical Morphology, to appear in *IEEE Tr. Power Delivery*

Sukumar Brahma, Fault Location in Power Distribution System with Penetration of Distributed Generation, to appear in *IEEE Tr. Power Delivery*

S.S. Venkata, S. M. Brahma, J. Stamp, and P. Kundur, "Continue Your Learning," *IEEE Power and Energy magazine*, Vol. 8-4, pp. 36-43, July 2010

S. M. Brahma, P. L. De Leon, R. G. Kavasseri, "Investigating the Option of Removing Anti-Aliasing Filter From Digital Relays," *IEEE Trans. Power Delivery*, Vol. 24-4, pp. 1864-1868, October 2009

S. M. Brahma, "Protecting Distribution Systems with Distributed Generation – Are We There Yet?" *Power Industry International - Volume 2 - Issue I*, June 2008

S. M. Brahma, "Iterative Fault Location Scheme for a Transmission Line Using Synchronized Phasor Measurements," *International Journal of Emerging Electric Power Systems*, Vol. 8-6, article 2, November 2007

S. M. Brahma, "Accurate Calculation of Fault Current Phasors for Use in Fault Location," *International Journal of Power and Energy Systems*, Vol. 27-3, pp. 299-304, August 2007.

S. M. Brahma, "Distance Relay with Out of Step Blocking Function using Wavelet Transform", *IEEE Trans. Power Delivery*, Vol. 22-3, pp. 1360-1366, July 2007

COURSES TAUGHT 2009–2010

EE 391: Introduction to Electric Power

EE 431/542: Power Systems II

EE 493/543: Power Systems III

EE 534: Power System Relaying

PROFESSIONAL DEVELOPMENT ACTIVITIES (last 5 years)

Member of 10 Working Groups of IEEE Power System Relaying Committee

Short Courses Attended: 24 Hours

NAME:

Sang-Yeon Cho

EDUCATION:

Bachelor of Science, Electrical and Computer Engineering, Sungkyunkwan University, South Korea, 1996

Master of Science, Electrical and Computer Engineering, Sungkyunkwan University, South Korea, 1998

Master of Science, Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta, GA, USA, 2000

Doctor of Philosophy, Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta, GA, USA, 2003

ACADEMIC EXPERIENCE:

New Mexico State University, ECE, Assistant Professor, 2007-present

Duke University, ECE, Assistant Research Professor, 2006-2007

Georgia Institute of Technology, ECE, Research Engineer, 2003-2004

NON-ACADEMIC EXPERIENCE:

Air Force Research Lab. (Hanscom, MA), Summer Faculty Scientist, 2008

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:

Member, Optical Society of America, OSA

Member, The Institute of Electrical and Electronics Engineers, IEEE

HONORS & AWARDS:

Winner of Grand Challenges Explorations Round 4, "A Low-cost, Rapid, and Sensitive Malaria Diagnostic Tool using Extraordinary Optical Transmission through Nanoholes," supported by *the Bill & Melinda Gates Foundation,* Primary Investigator, 2010

INSTITUTIONAL AND PROFESSIONAL SERVICE IN THE LAST 5 YEARS:

Reviewer Journal of Physics: Cond. Matter, J. of Optics A: Pure and Applied Optics, Journal of Physics and Chemistry of Solids, IEEE Journal of Lightwave Technology, IEEE Transaction on Electronic Devices, IEEE Photonics Technology Letters, OSA Optics Express, OSA Applied Optics, OSA Optics Letters, ACS Nano Letters, IOP Nanotechnology, IEEE Design & Test of Computer.

National Science Foundation (NSF) Panelist, 2010

PRINCIPAL PUBLICATIONS/PRESENTATIONS IN THE LAST FIVE YEARS:

R. A. Soref, S. Y. Cho, W. R. Buchwald, R. E. Peale, and J. W. Cleary, “Silicon plasmonic waveguides”, in An Introduction to Silicon Photonics, S. Fathpour and B. Jalali, Editors, Taylor and Francis UK (2010)

Sang-Yeon Cho, D. K. Borah, “Chip-scale hybrid optical sensing systems using digital signal processing,” *OSA Optics Express*, 17, pp. 150-155, 2009

Sang-Yeon Cho and Richard Soref, “Low-loss silicide/silicon plasmonic ribbon waveguides for mid- and far-infrared applications,” *OSA Optics Letters*, vol. 34, pp. 1759-1761, 2009

Aloyse Degiron, Sang-Yeon Cho, Talmage Tyler, Nan Marie Jokerst, and David R Smith, “Directional coupling between dielectric and long-range plasmon waveguides,” *New Journal of Physics*, 11, 015002, 2009

T. Driscoll, S. Palit, M. M. Qazilbash, M. Brehm, F. Keilmann, Byung-Gyu Chae, S.-J. Yun, H.-T. Kim, S. Y. Cho, N. Marie Jokerst, D. R. Smith, and D. N. Basov, “Dynamic tuning of an infrared hybrid-metamaterial resonance using vanadium dioxide,” *Applied Physics Letters*, 93, 024101, 2008

Aloyse Degiron, Sang-Yeon Cho, Cameron Harrison, Nan Jokerst, Claudio Dellagiacoma, Olivier J. F. Martin, David R. Smith, “Experimental comparison between conventional and hybrid long-range surface plasmon waveguide bends,” *Physical Review A*, vol. 77, 021804, 2008..

Sang-Yeon Cho and Nan Marie Jokerst, “Integrated Thin Film Photodetectors with Vertically Coupled Microring Resonators for Chip Scale Spectral Analysis,” *Applied Physics Letters*, vol. 90, 101105, 2007

Sang-Yeon Cho and Richard Soref, “Interferometric microring-resonant 2 x 2 optical switches,” *OSA Optics Express,* vol. 16, pp. 13304-13314, 2008

T. Driscoll, G. O. Anreev, D. N. Basov, S. Palit, S. Y. Cho, N. M. Jokerst, and D. R. Smith, “Tuned permeability in terahertz split-ring resonators for devices and sensors,” *Applied Physics Letters*, 91, 062511, 2007.

T. Driscoll, G. O. Andreev, D. N. Basov, S. Palit, Tong Ren, Jack Mock, Sang-Yeon Cho, Nan Marie Jokerst, and D. R. Smith, “Quantitative investigation of a terahertz artificial magnetic resonance using oblique angle spectroscopy,” *Applied Physics Letters*, 90, 092508, 2007.

Sang-Woo Seo, Sang-Yeon Cho, and Nan Marie Jokerst, “An Integrated Thin Film InGaAsP Laser and 1x4 Polymer Multimode Interferometric Splitter on Silicon,” *OSA Optics Letters,* vol. 32, pp. 548-550, 2007

COURSES TAUGHT 2009–2010:

EE380 Electronics I

EE425 Introduction to Semiconductor

EE490 Advanced Optical Devices and Systems

EE201 Networks I

PROFESSIONAL DEVELOPMENT ACTIVITIES IN THE LAST 5 YEARS:

Talks attended at IEEE/OSA Conferences: 8

Seminars attended at New Mexico University: 10

NAME:

Charles D. Creusere

EDUCATION:

BS, Electrical and Electronics Engineering, University of California at Davis, 1985

MS, Electrical and Electronics Engineering, University of California at Santa Barbara, 1990

Ph.D., Electrical and Electronics Engineering, University of California at Santa Barbara, 1993

ACADEMIC EXPERIENCE:

New Mexico State University, 2000-2004 Assistant Professor 2004-2009 Associate Professor, 2009-present Professor

NON-ACADEMIC EXPERIENCE:

Naval Weapons Center, China Lake, CA, 1985-1989

AT&T Bell Laboratories, Murray Hill, NJ, Summer 1992

Naval Air Warfare Center, China Lake, CA, 1993-1999

CERTIFICATIONS AND PROFESSIONAL REGISTRATIONS, CONSULTING, PATENTS, ETC.:

Consulting

Haynes&Boone LLP. Patent Attorneys, Expert witness, Realtime v. ATT, April 2011-present; Osterlenk, Gerb, Faber & Soffen, Expert witness, LTI v. Nikon, 2001-2003; Abba Tech, Technology Consultant, 2000; Invertix, Technology Consultant, 2006-present.

US Patents:

Patent titled "Parallel digital image compression system which exploits zerotree redundancies in wavelet coefficients," Patent Number 6,148,111.

Patent titled "Efficient embedded image and video compression using lifted wavelets," Number: 6,466,698, granted October 15, 2002.

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:

Institute of Electrical and Electronics Engineers (IEEE), Senior Member

HONORS & AWARDS:

Awarded the International Foundations for Telemetering Professorship in October 2008; Awarded the Frank Carden Chair in Telemetering & Telecommunications in January 2010.

INSTITUTIONAL AND PROFESSIONAL SERVICE IN THE LAST 5 YEARS:

Associate Editor IEEE Transactions on Image Processing, Associate Editor IEEE Transactions on Image Processing,

Associate Editor IEEE Transactions on Multimedia,

Technical Program Committee, Data Compression Conference 2011,

Technical Program co-Chair, IEEE Southwest Symposium on Image Analysis and Interpretation, 2012,

Chair, College of Engineering Research & Development Team,

Member, College of Engineering Promotion and Tenure Committee,

Member, ECE Dept. Graduate Studies Committee,

Reviewer: ICASSP, ICIP, DCC, NSF.

PRINCIPAL PUBLICATIONS/PRESENTATIONS I(last year):

V. Thilak, C.D. Creusere, and D. Voelz, "Passive polarimetric imagery-based material classification robust to illumination source position and viewpoint," *IEEE Transaction on Image Processing, January 2011.*

Mecimore, Ivan; Creusere, Charles D.; , "Low complexity multi-view distributed video coding based on JPEG," *Image Analysis & Interpretation (SSIAI), 2010 IEEE Southwest Symposium on* , vol., no., pp.165-168, 23-25 May 2010.

Creusere, C.D.; Mehta, K.; Voelz, D.G.; , "Model-based estimation of surface geometry using passive polarimetric imaging," *Geoscience and Remote Sensing Symposium (IGARSS), 2010 IEEE International* , vol., no., pp.4557-4560, 25-30 July 2010.

Castorena, J.; Creusere, C.D.; Voelz, D.; , "Modeling lidar scene sparsity using compressive sensing," *Geoscience and Remote Sensing Symposium (IGARSS), 2010 IEEE International* , vol., no., pp.2186-2189, 25-30 July 2010.

Castorena, J.; Creusere, C.D.; Voelz, D.; , "Using finite moment rate of innovations for LIDAR waveform complexity estimation," *Asilomar Conference on Signals, Systems, and Computers*, Nov. 2010.

PROFESSIONAL DEVELOPMENT ACTIVITIES IN THE LAST 5 YEARS:

Research papers presented at 19 papers presented at 11 different conferences;

Attended 11 teaching academy/Advance/ITC training events

NAME:

Muhammad Dawood

EDUCATION:

Doctor of Philosophy, Electrical Engineering, University of Nebraska-Lincoln, Nebraska, 2001

Master of Science, Electrical Engineering, University of Nebraska-Lincoln, Nebraska, 1998

Bachelor of Engineering, Avionics Engineering, NED University of Engineering and Technology, Karachi, Pakistan, 1985

Diploma in Radar Technology, School of Electronics, Karachi, Pakistan, 1980

ACADEMIC EXPERIENCE:

NMSU-Las Cruces, Assistant Professor Tenure-Track, Full-time 2005-present

KU-Lawrence, Research Assistant Professor, Full-time 2002-2005

UNL-Lincoln, Instructor, Full-time 2002-2002

UNL-Lincoln, Research/Teaching Assistant, Half-time 1996-2001

School of Electronics, Karachi, Pakistan, Progress and Training Control Officer, Full-time 1994-1994

National University of Science and Technology-Pakistan, Instructor, Department of Avionics, Full-time 1990-1993

NON-ACADEMIC EXPERIENCE:

Tellabs Research Center-Mishawaka, Research Engineer, Full-time 2001-2001

PIA-Karachi, Pakistan, Project Development Engineer, Full-time 1995-1996

PAF-Sargodha, Pakistan, Electronic Engineer, Full-time 1987-1990

PAF-Peshawar, Pakistan, Maintenance Engineer, Full-time 1985-1987

CONSULTING, PATENTS, ETC.:

US Patents:

US 61-353136 (provisional patent), An Experimental Method to Detect and Process Precursors at Microwave Frequencies for Greater Penetration Depths and Enhanced Imaging Through Dispersive Media 2010

US 61-370773 (provisional patent), Extended Optimal Filters for

Adaptive Radar Systems Using Binary Codes 2010

PROFESSIONAL REGISTRATION:

None

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:

Institute of Electrical and Electronics Engineers

HONORS & AWARDS:

None

INSTITUTIONAL AND PROFESSIONAL SERVICE IN THE LAST 5 YEARS:

Manuscript Reviewer for IEEE Geo Science and Remote Sensing Letters (GRSL), IEEE Trans. Aerospace and Electronics Systems (AES), Institute of Electrical Technology (IET, formerly IEE), NSF, and AFOSR, 2003-present

Member, Engineering Physics ABET Committee, EE Representative since November 2009

Member, College of Engineering UG Research Committee, since November 2010.

Member, College of Engineering Student Evaluation Committee, since Spring 2010.

Member, Undergraduate Studies Committee, since 2008.

Advisor, IEEE Student Chapter, NMSU, since 2007

PRINCIPAL PUBLICATIONS/PRESENTATIONS IN THE LAST FIVE YEARS:

A. V. Alejos, M. Dawood, and L. Medina, "Experimental dynamical evolution of the Brillouin precursor for broadband wireless communication through vegetation," Journal of Electromagnetic Waves and Applications, Progress In Electromagnetic Research, PIER 111, 291-309, 2011

A. V. Alejos, M. Dawood, and H. U. Mohammed, "Analysis of Brillouin precursor propagation through foliage for digital sequence of pulses", *IEEE Geoscience and Remote Sensing Letters*, Vol. 8, No. 1, Jan. 2011, pp. 59-63

A. V. Alejos, M. Dawood, H. U. R. Mohammed, M. Garcia Sanchez, and I. Cuiñas, "Educational System to Approach Teaching of Bi-static Noise Radar," The Journal of *Electronics and Electrical Engineering* (Elektronika Ir Elektrotechnika, *ISSN 1392 – 1215)*, No. 6(102), 2010, pp. 71-74.

M. Dawood, H. U. R. Mohammed, and A. V. Alejos, "Experimental Detection of Brillouin Precursors Through Tap Water at Microwave Frequencies", Electronics Letters, 46, 1645, 2010.

B. Uhl, M. Dawood, and S. Castillo, "Quadrature-Modulated Circular Microstrip Patch Antenna for Phased Arrays," IEEE Antennas and Wireless Propagation Letters, Vol. 9, 2010, pp. 958-961.

Ana Vazquez Alejos, Manuel Garcia Sanchez, Mohammad Dawood, Iñigo Cuiñas Gomez, Chapter "Wideband Noise Radar based in Phase Coded Sequences", in book "Radar Technology", ISBN 978-953-307-029-2, edited by Guy Kouemou, published by IN-TECH (www.intech.org), Vienna (Austria), 2009

COURSES TAUGHT 2009–2010:

EE541/454-Antennas; EE548/452-Radar Systems; EE590/490-RF/Microwave Wireless Systems; and EE351-Applied Electromagnetics

PROFESSIONAL DEVELOPMENT ACTIVITIES IN THE LAST 5 YEARS:

Talks attended at IEEE conferences, and other National/International Conferences, Meetings, Workshops, etc. : > 300

Seminars/Workshops participated at teaching Academy NMSU: >230 hours

NAME:

Phillip L. De Leon

EDUCATION:

BS, Electrical Engineering, Univ of Texas at Austin, 1989

BA, Mathematics, Univ of Texas at Austin, 1990

MS, Electrical Engineering, Univ of Colorado at Boulder, 1992

Ph.D., Electrical Engineering, Univ of Colorado at Boulder, 1995

ACADEMIC EXPERIENCE:

New Mexico State University, Professor, 1996 - present

Technical University Vienna, Austria (TU-Wien), School of Electrical Engineering, Visiting Professor, 2008

University College Cork, Ireland (UCC), Department of Computer Science, Visiting Professor, 2002

NON-ACADEMIC EXPERIENCE:

AT&T Bell Laboratories, Murray Hill, NJ, Cooperative Research Fellow, 1993, 1994

CONSULTING, PATENTS, ETC.:

Recent Consulting:

Invertix Corp. (McClean, VA), Consultant, 2006 - present

NetLogic (Mountain View, CA), Consultant, 2010-present

US Patents:

US 7,720,012 Speaker Identification in the Presence of Packet Losses, 2010

US 5,553,014 Adaptive Finite Impulse Response Filtering Method and Apparatus, 1996

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:

Institute of Electrical and Electronics Engineers (IEEE), Senior Member

HONORS & AWARDS:

U. S. Department of State, Fulbright Faculty Scholar Award, Austria, 2008

INSTITUTIONAL AND PROFESSIONAL SERVICE IN THE LAST 5 YEARS:

Associate Department Head for Graduate Studies and Research, 2011 - present

IEEE Industry Digital Signal Processing Technology (IDSP) Standing Committee, 2010-2012

University Research Council (URC), NMSU, 2009-2010 (College of Engineering Representative), 2010-2011 (Chairman)

IEEE Transactions, *IEEE ICASSP conference* paper reviewer

PRINCIPAL PUBLICATIONS/PRESENTATIONS IN THE LAST FIVE YEARS:

P. L. De Leon, I. Hernaez, I. Saratxaga, M. Pucher, and J. Yamagishi, “Detection of Synthetic Speech for the Problem of Imposture,” *IEEE Int. Conf. on Acoustics, Speech & Signal Processing* (ICASSP), 2011.

V. Apsingekar and P. L. De Leon, “Speaker Verification Score Normalization Using Speaker Model Clusters,” *Speech Communication*, vol. 53, no. 1, pp. 110 - 118, Jan. 2011.

S. M. Brahma, R. G. Kavasseri, and P. L. De Leon, “Oversampling in Digital Relays,” *IEEE Trans. Power Delivery*, vol. 24, no. 4, pp. 1864 - 1868, Oct. 2009.

V. Apsingekar and P. L. De Leon, “Speaker Model Clustering for Efficient Speaker Identification in Large Population Applications,” *IEEE Trans. Audio, Speech, Lang Process*., vol. 17, no. 4, pp. 848-853, May 2009.

A. Daga, G. Lovelace, D. Borah, and P. De Leon, “Terrain-Based Simulation of IEEE 802.11a and b Physical Layers on the Martian Surface,” *IEEE Trans. Aerosp. Electron. Syst*, vol. 43, no. 4, Oct. 2007.

COURSES TAUGHT 2009–2010:

EE565 Pattern Recognition and Machine Learning (Spring 2010)

EE312 Signals and Systems I (Spring 2010)

EE311 Signals and Systems (Fall 2009)

EE395 Introduction Digital Signal Processing (Fall 2009, Fall 2010)

EE442/EE592 Real-Time Digital Signal Processing (Spring 2009)

PROFESSIONAL DEVELOPMENT ACTIVITIES IN THE LAST 5 YEARS:

Research conferences presented at: 6

Invited talks: 2

NAME:

Paul M. Furth

EDUCATION:

B.A., French, Grinnell College, Grinnell, IA, 1984.

B.S., Engineering (Electrical), California Institute of Technology, Pasadena CA, 1985.

M.S., Electrical and Computer Engineering (Area: Subthreshold CMOS), Johns Hopkins University, Baltimore MD, 1991.

Ph.D., Electrical and Computer Engineering (Area: Subthreshold CMOS), Johns Hopkins University, Baltimore MD, 1996.

ACADEMIC EXPERIENCE:

New Mexico State University (NMSU), Las Cruces, NM, Assistant Professor of

Electrical and Computer Engineering, 1995-2000

NMSU, Associate Professor, 2000-Present

NMSU, Assoc. Dept. Head, 2002-2006 and 2011-Present

NMSU, Instructor of Pre-freshman Engineering Program, Summer 2005

NMSU, Interim Department Head, 2009-2010

NON-ACADEMIC EXPERIENCE:

Sandia National Labs, Albuquerque, NM, University Summer Faculty, Design of High-

Dynamic Range Pixel Design for Imager, Summer 2008.

Micron, Boise, ID, Visiting Faculty, SRAM Design for CMOS Imagers, Summer 2007.

Motorola, Chandler, AZ, Consulting IC Designer, Design of Switched-Capacitor

Amplifier for CMOS Imager, Design of Power Management and Audio Circuits for portable game player, Summers 2001-2003.

JTA Research, Seal Beach CA, Consulting IC Designer, SRAM Design, Summer 2000.

Johns Hopkins University Applied Physics Laboratory, Columbia, MD, Member of Associate Staff , Audio Experiments with Electronic Model of Ear, 1992-1995, part-time.

TRW Technar, Irwindale, CA, Project Engineer, Design of Shock Vibration testers for Automotive Airbag Crash Sensors,1985-1989.

CERTIFICATIONS AND PROFESSIONAL REGISTRATIONS:

none

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:

Institute of Electrical and Electronics Engineers (IEEE), Member

NMSU Teaching Academy, Member

HONORS & AWARDS:

NMSU College of Engineering, Bromilow Teaching Award for Teaching Excellence, 2008

INSTITUTIONAL AND PROFESSIONAL SERVICE IN THE LAST 5 YEARS:

Member, Steering Committee, IEEE Midwest Symposium on Circuits and Systems, 2011-present

Volunteer, New Mexico BEST Robotics, 2009-present

Reviewer, *IEEE Transactions on Circuits and Systems* and *IEEE Journal of Sensors*

Member/Chair, ECE Undergraduate Studies Committee, 1998-2002, 2009-present

ECE Representative, BS in Engineering Physics Committee, 2006-2010

Advisor for HKN (EE Honor Society) Student Organization, 1998-1999, 2009-2010

Advisor for NMSU IEEE Student Branch, 2009-2010

PRINCIPAL PUBLICATIONS/PRESENTATIONS IN THE LAST FIVE YEARS:

"Integrated CMOS Sensor Array for Optical Heterodyne Phase Sensing," P. M. Furth, V. Ponnapureddy, S. Dundigal, D. Voelz, A. Garimella, M.W. Rashid, *IEEE Sensors Journal*, Feb. 2011.

"On the Design of Low-Power CMOS Comparators with Programmable Hysteresis," P. M. Furth, Y.-C. Tsen, V. B. Kulkarni, and T. K. Poriyani House Raju, *53rd IEEE Midwest Symposium on Circuits and Systems*, pp. 1077-1080, Seattle, WA, August 2010.

"An Adaptive Biasing Technique to Convert a Pseudo-Class AB Amplifier to Class AB," M. W. Rashid, A. Garimella, and P. M. Furth, *IET Electronics Letters*, vol. 46, no. 12, pp. 820-822, Jun. 2010.

"Reverse Nested Miller Compensation Using Current Buffers in a Three-Stage LDO," A. Garimella, M. W. Rashid, and P. M. Furth, *IEEE Trans. on Circuits and Systems–II*, vol. 57, no. 4, pp. 250–254, April 2010.

"A 1.21V, 100mA, 0.1µF-10µF output capacitor low drop-out voltage regulator for SoC applications," A. Garimella and P.M. Furth, *Proc. of IEEE Int. Conf. Electronics, Circuits, and Systems*, Medina, Tunisia, pp. 375-378, Dec. 2009.

PROFESSIONAL DEVELOPMENT ACTIVITIES IN THE LAST 5 YEARS:

NMSU Advancing Leaders Program, Leadership Mentoring Program, 2010-2011.

ECEDHA and SWECEDHA Conferences

Electrical and Computer Engineering Department Head 2010

NAME:

Hong Huang

EDUCATION:

Ph.D., December 2002, Georgia Institute of Technology, Atlanta, USA, in Electrical and Computer Engineering.

MS, May 2000, Georgia Institute of Technology, Atlanta, USA, in Electrical and Computer Engineering.

Bachelor of Engineering, Tsinghua University, Beijing, China.

ACADEMIC EXPERIENCE:

Assistant Professor, Klipsch School of Electrical Engineering, New Mexico State University, 2003-2009.

Associate Professor, Klipsch School of Electrical Engineering, New Mexico State University, 2009-now.

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:

Institute of Electrical and Electronics Engineers, Member

HONORS & AWARDS:

Best Papers 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.

PRINCIPAL PUBLICATIONS/PRESENTATIONS IN THE LAST FIVE YEARS:

H. Huang, N. Ahmed and S. Pullurul, “Jamming Dust: A Low-Power Distributed Jammer Network,” in *Proc. of 27th Army Science Conference*, 2010.

R. Asorey-Cacheda, H. Huang, F. J. Gonz´alez-Casta˜no, E. Johnson, C. Lopez- Bravo and F. Gil-Castineira, “A Joint Interchannel and Network Coding Schema for nVoD Services over Wireless Mesh Networks,” in *Proc. of IEEE Globecom*, 2009.

H. Huang, “The Connection Between Information Theory and Object Search in Networks,“ *IEEE Communications Letters,* Vol. 12, No. 12, 2008.

H. Huang and R. R. Manda, “Exploring Performance Landscape of Unstructured Search Schemes,” in *Ubiquitous Computing and Communication Journal*, Vol. 3, No.4, 2008.

H. Huang, “Distributed Computing in Wireless Sensor Networks,” in *Encyclopedia of Mobile Computing and Commerce*, book chapter, edited by D. Taniar, Information Science Reference (an imprint of IGI), Hershey, PA, 2007.

H. Huang, “Mechanisms to Mitigate Inefficiency in Greedy Geographical Routing in Wireless Ad-hoc Networks,” in *IEEE Communications Letters*, Vol. 10, No. 3, 2006.

H. Huang and J. A. Copeland, “Optical networks with hybrid routing,” in *IEEE Journal on Selected Areas in Communication*, Vol. 21, No. 7, 2003.

H. Huang and J. A. Copeland, “A series of Hamiltonian cycle based solutions to provide simple and scale mesh optical network resilience,” in *IEEE Communications*, Vol. 40, No. 11, 2002.

COURSES TAUGHT 2009–2010:

EE261 Digital Design

EE469 Communications Networks

EE563 Computer Performance Analysis

EE569 Advanced Communications Networks

PROFESSIONAL DEVELOPMENT ACTIVITIES IN THE LAST 5 YEARS:

Attended NSF workshops, NMSU Teaching Academy workshops

NAME:

Joerg Kliewer

EDUCATION:

MSEE (Dipl.-Ing. degree), Hamburg University of Technology, Germany, 1993

Ph.D. (Dr.-Ing. degree), University of Kiel, Germany, 1999

ACADEMIC EXPERIENCE:

University of Kiel, Germany, Lecturer 1999–2003

Visiting Senior Research Fellow, University of Southampton, U.K. 2004–2005

Visiting Assistant Professor, University of Notre Dame 2005–2007

Assistant Professor, New Mexico State University, Tenure-Track 2007–2011

NON-ACADEMIC EXPERIENCE:

Philips Semiconductors, VLSI design engineer, internship 1992

CONSULTING, PATENTS, ETC.:

US 7068216 Method for the linearization of FMCW radar devices 2006

Also European Patent EP1464982, German Patent DE10315012

PROFESSIONAL REGISTRATION:

None

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:

Institute of Electrical and Electronics Engineers, Senior Member

HONORS & AWARDS:

Leverhulme Trust Fellow, 2003; German Research Foundation Fellowship, 2004

INSTITUTIONAL AND PROFESSIONAL SERVICE IN THE LAST 5 YEARS:

Associate Editor, EURASIP Journal on Advances in Signal Processing, 2005-2009

Associate Editor, IEEE Transactions on Communications, since 2008

Member Editorial Board IEEE Information Theory Society Newsletter, since 2009

Member technical program committee: IEEE GLOBECOM 2009/2010, IEEE Information Theory Workshop 2009, IEEE Intern. Conf. on Communications 2010/2011, IEEE Vehicular Technology Conf. 2011, Eighth Intern. Symposium on Wireless Communication Systems

Advisory board member of GAIN (German Academic International Network), since 2010

Panelist National Science Foundation (CISE, 2007, 2009)

PRINCIPAL PUBLICATIONS/PRESENTATIONS IN THE LAST FIVE YEARS:

J. Kliewer, R. Thobaben: Iterative joint source-channel decoding of variable-length codes using residual source redundancy. IEEE Trans. Wireless Commun., May 2005

R. Thobaben, J. Kliewer: Low complexity iterative joint source-channel decoding for variable-length encoded Markov sources. IEEE Trans. Commun., Dec. 2005

J. Kliewer, N. Goertz, A. Mertins: Joint source-channel decoding with Markov random field source models. IEEE Trans. Signal Proc., Oct. 2006

R. G. Maunder, J. Kliewer, S. X. Ng, J. Wang, L.-L. Yang, L. Hanzo: Joint iterative decoding of trellis-based VQ and TCM for bandwidth-efficient video transmission. IEEE Trans. Wireless Commun. April 2007

S. Puducheri, J. Kliewer, T. E. Fuja: The design and performance of distributed LT codes. IEEE Trans. Information Theory, Oct. 2007

L. Xiao, T. E. Fuja, J. Kliewer, D. J. Costello, Jr.: A network coding approach to cooperative diversity, IEEE Trans. Information Theory, Oct. 2007

R. Thobaben, J. Kliewer: An efficient variable-length code construction for iterative source-channel decoding. IEEE Trans. on Commun., July 2009

T. Cui, T. Ho, J. Kliewer: Relay strategies for memoryless two-way relay channels: Performance analysis and optimization. IEEE Trans. Commun., Oct. 2009

L. Xiao, T. E. Fuja, J. Kliewer, D. J. Costello, Jr.: Error performance analysis of signal superposition coded cooperative diversity. IEEE Trans. Commun., Oct. 2009

M. Andersson, V. Rathi, R. Thobaben, J. Kliewer, M. Skoglund: Nested polar codes for wiretap and relay channels. IEEE Communication Letters, Aug. 2010.

T. Dikaliotis, T. Ho, S. Jaggi, S. Vyetrenko, H. Yao, M. Effros, J. Kliewer, E. Erez: Multiple-access network information-flow and correction codes. IEEE Trans. Information Theory, Feb. 2011.

COURSES TAUGHT 2009–2010:

EE 571 Random Signal Analysis, EE 581 Digital Communications,

EE 586 Information Theory, EE 572 Coding Theory

PROFESSIONAL DEVELOPMENT ACTIVITIES IN THE LAST 5 YEARS:

Attended 17 IEEE conferences during the last five years

NAME:

Kwong Ng

EDUCATION:

Bachelor of Engineering, Electrical Engineering, McGill University, Canada, 1979

Master of Science, Electrical Engineering, The Ohio State University, 1981

Doctor of Philosophy, Electrical Engineering, The Ohio State University, 1985

ACADEMIC EXPERIENCE:

University of Virginia, Research Assistant Professor, Full-time	1985
University of Virginia, Assistant Professor, Full Time	1986-1989
New Mexico State University, Associate Professor, Full-time	1990-1993
New Mexico State University, Associate Professor with Tenure, Full-time	1993-1995
New Mexico State University, Full Professor with Tenure, Full-time	1995-

NON-ACADEMIC EXPERIENCE:

None

PROFESSIONAL REGISTRATION:

None

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:

Institute of Electrical and Electronic Engineers

HONORS & AWARDS:

Paul W. and Valerie Klipsch Distinguished Professor
Who’s Who Among America’s Teachers
Who’s Who in Science and Engineering
Who’s Who in America

INSTITUTIONAL AND PROFESSIONAL SERVICE IN THE LAST 5 YEARS:

NMSU College of Engineering Research and Development Team
NMSU Library Liaison, Electrical and Computer Engineering
NMSU ECE Graduate Studies Committee
NMSU ECE Promotion and Tenure Committee
NMSU Department Advisory Committee

NMSU ECE Faculty Search Committee

NMSU Director, Electromagnetics Laboratory

NMSU Graduate Examination Committees

Reviewer, IEEE Transactions, Med. & Biol. Eng. & Comput., Review of Scientific Instruments

PRINCIPAL PUBLICATIONS/PRESENTATIONS IN THE LAST FIVE YEARS:

H.V. Dang, K.T. Ng, and J.K. Kroger, "Novel beamformers for multiple correlated brain source localization and reconstruction," Proc. 36th International Conference on Acoustics, Speech and Signal Processing, Prague, Czech Republic, May 2011.

H.V. Dang, K.T. Ng, and J.K. Kroger, "Novel vector beamformers for EEG source imaging," Proc. 2011 IEEE International Symposium on Biomedical Imaging, Chicago, IL, March 2011.

H.V. Dang and K.T. Ng, "Finite Difference Neuroelectric Modeling Software," Journal of Neuroscience Methods, in press.

O.C. Deale, K.T. Ng, and B.B. Lerman, "Orthogonal field calibration analysis for myocardial electrode arrays used in defibrillation studies," IEEE Trans. Biomed. Eng., vol. 55, pp. 2823-2826, 2008.

D.N. Barnes, J.S. George, and K.T. Ng, "Finite difference iterative solvers for electroencephalography: serial and parallel performance analysis," Med. & Biol. Eng. & Comput., vol. 46, pp. 901-910, 2008.

O.C. Deale, K.T. Ng, and B.B. Lerman, "Calibrated current divider network for precision current delivery during high-voltage transthoracic defibrillation," IEEE Trans. Biomed. Eng., vol. 52, pp. 1970-1973, 2005.

PROFESSIONAL DEVELOPMENT ACTIVITIES IN THE LAST 5 YEARS:

Conferences Attended: 8

Seminars attended at NMSU: 32

NAME:

Vojin G. Oklobdzija

EDUCATION:

MSEE and BSEE (Electronics and Telecommunications, University of Belgrade, Yugoslavia) 1968, 1971.

MSc (Computer Science) University of California Los Angeles, 1978.

Ph.D. (Computer Science) University of California Los Angeles, 1982.

ACADEMIC EXPERIENCE:

New Mexico State University, Klipsch School of Electrical and Computer Engineering, Las Cruces New Mexico, Dept Head 2010-2011:

University of Texas at Dallas, Dallas Texas, Visiting Professor, 2007-2010:

Sydney University, Sydney, Australia Chair Professor / Visiting Professor 2005 - 2007

Ecole Polytechnique Federale de Lausanne, Lausanne, Switzerland, Visiting Professor, 2004

Korea Information Technology Assessment Program, Seoul, Korea, Distinguished Visiting Professor 2003

University of California, Electrical and Computer Engineering, Davis California, Professor / Emeritus Professor 1991 - on

University of California Berkeley, Berkeley California, Visiting IBM Faculty June 1988 -1990

University of Belgrade, Yugoslavia, Faculty Member (Assistant Professor), 1974 - 1976

NON-ACADEMIC EXPERIENCE:

Uhur Security, Director of Computer Operations	1977-1980
Armco Security, Director of Computer Operations	1980-1983

CONSULTING, PATENTS, ETC.: (Partial List)

Samsung, Consultant and Advisor, Korea. Nov. – Dec. 2003:

Intel Advanced Microprocessor Research Laboratories, Hillsboro, Oregon. May 2002 – September 2002:

SONY, LSI Systems Laboratories, Consultant, 1997 - 2001:

CONSISTENT PRECHARGE CIRCUIT FOR CASCODE VOLTAGE SWITCH LOGIC, US Patent No. 4,700,086.

REGISTER SELECTION MECHANISM AND ORGANIZATION OF AN INSTRUCTION PREFETCH BUFFER, US Patent No. 4,847,759.

INSTRUCTION PREFETCH BUFFER CONTROL, US Patent No. 4,714,994.

INSTRUCTION CONTROL MECHANISM FOR A COMPUTING SYSTEM WITH REGISTER RENAMING AND QUEUES INDICATING AVAILABLE REGISTERS, US Patent No. 4,992,938.

PROFESSIONAL REGISTRATION: None

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:

Institute of Electrical and Electronics Engineers

American Society for Engineering Education

HONORS & AWARDS:

Fulbright Scholarship, 1976-77; National Science Fellowship, Plasma Physics, 1971-73; IBM patent award, 1985; IBM invention plateau award, 1985; Best Paper Award in Computer Architecture track, HICSS-88; Fulbright Professorship, 1990. Peru, South America.N. Price Fellowship in Electrical Engineering, Australia 1993; Fellow IEEE, 1995; Distinguished Lecturer of IEEE Circuits and Systems Society; Distinguished Lecturer of IEEE Solid-State Circuits Society; Outstanding Academic Title, “Computer Engineering Handbook”, CRC Press 2002.

INSTITUTIONAL AND PROFESSIONAL SERVICE IN THE LAST 5 YEARS:

IEEE-CAS: Vice-President, Technical Activities, Member of the Executive Committee, Member of the Board of Governors; Editorial Board, IEEE MICRO; International Solid-State Circuits Conference (ISSCC) program committee; Int’l Symposium on VLSI Technology;

PRINCIPAL PUBLICATIONS/PRESENTATIONS IN THE LAST FIVE YEARS(Partial List)

V. G. Oklobdzija, *“Clocking and Clocked Storage Elements in Multi-GHz Environment”*, invited paper, IBM Journal of Research and Development, Vol. 47, No. 5/6, pp. 567-584, September/November 2003.

N. Nedovic, W. Walker, V. G. Oklobdzija, *“A Test Circuit for Measurement of Clocked Storage Element Characteristics”*, IEEE Journal of Solid-State Circuits, Vol.29, No.8, August 2004.

N. Nedović, V. G. Oklobdzija, "Dual-Edge Triggered Storage Elements and Clocking Strategy for Low-Power Systems", *IEEE Transaction on VLSI Systems*, Volume 13, Issue 5, pp. 577-590, May 2005.

V. G. Oklobdzija, B. R. Zeydel, H. Q. Dao, S. Mathew, R. Krishnamurthy, "Comparison of High-Performance VLSI Adders in Energy-Delay Space", *IEEE Transaction on VLSI Systems*, Volume 13, Issue 6, pp. 754-758, June 2005.

S. K. Hsu, S. K. Mathew, M. A. Anders, B. R. Zeydel, V. G. Oklobdzija, R. K. Krishnamurthy, S. Y. Borkar, *“A 110 GOPS/W 16-bit Multiplier and Reconfigurable PLA Loop in 90-nm CMOS”*, IEEE Journal of Solid-State Circuits, Vol.41, No.1, January 2006.

COURSES TAUGHT 2011–2012(At NMSU)

EE 418 Capstone Design 1

Name

Robert Paz

Education

Ph.D, Electrical Engineering, May 1991, University of Illinois

M.S., Electrical Engineering, May 1987, University of Illinois

B.S., Electrical Engineering, May 1985, New Mexico State University

Academic Experience

Associate Professor, New Mexico State University, 9.5 years

Assistant Professor, New Mexico State University, 7.5 years

Teaching Assistant, University of Illinois, 2 years

Non-Academic Experience

1984-1987, Summer Intern, Eastman Kodak Company, Rochester, NY

1988-1990, Summer Research Assistant, Coordinated Science Laboratory, University of Illinois.

2006 Boeing Faculty Fellowship

Consulting, Patents

none

States of Registration

none

Principle Publications (last 5 years)

R.A. Paz (2011), Computer Control Systems, undergraduate controls textbook, under preparation.

Paz, R.A. (2011), "Noncausal Velocity Estimates from Incremental Encoders for Identification of Robotic Systems," submitted for the IEEE Conference on Decision and Control, Orlando, FL

Khaled Hatamleh, Ou Ma and Robert Paz (2010). "A UAV Model Parameters Identification Method", *Proceedings of the AIAA Guidance Navigation and Control Conference*, Toronto, Ontario Canada.

Hatamleh , K. S., O. Ma, and R. Paz (2009) "An UAV Model Parameter Identification Method: A Simulation Study," *International Journal of Information Acquisition*, vol. 6, pp 225-238.

Hatamleh , K. S., O. Ma, and R. Paz (2009) "In-flight UAV Parameter Identification: A Simulation Study," *Proceedings of the AIAA Atmospheric Flight Mechanics Conference*, August 10-13, Chicago

Liang, J., A. Hernandez, O. Ma, B. Qiao, and R. Paz, (2009) "Nonhuman Test of an Active Body Support System for Improving Locomotion Training," *Proc. of the IEEE/ ASME International Conference on Advanced Intelligent Mechatronics*, July 14-17, Singapore

O. Ma, A. Hernandez, and R. Paz (2008), "Testbed for Testing an Active Body Support System for Locomotion Training," Proceedings of the IEEE/ASME International Conference on Advanced Intelligent Mechatronics, July 2-5, 2008, Xian, PRC.

Diao, X., O. Ma, and R. Paz (2006), "Study of 6-DOF cable-robots for potential application of HIL microgravity contact-dynamics simulation", *Proc. AIAA Modeling and Sim. Tech. Conf. and Exhibit*, Keystone, CO, AIAA-2006-6732

R.A. Paz (2006), "Ripple-Free Tracking with Robustness," *International Journal of Control*, vol. 79, no. 6, pp. 543-568.

Scientific & Professional Societies

Institute of Electrical and Electronic Engineers (IEEE)

Control Systems Society of the IEEE, Member of the Technical

Committee on Robust Control (TCRC), and the Technical Committee on Education

Eta Kappa Nu, Gamma Chi Chapter Advisor

Tau Beta Pi, Engineering Honor Fraternity

Sigma Xi, The Scientific Research Society

Honors & Awards

none

Institutional & Professional Service (last 5 years)

Westhafer Award Selection Committee (3 years)

HKN Chapter Advisor (11 years)

Klipsch School Undergraduate Studies Committee (Chair, 2yrs)

Teaching Academy Board Member (3 years)

Faculty Senate (1 year)

Professional Development (last 5 years)

Teaching Academy Distinguished Member (3 years)

Boeing-Welliver Faculty Fellow

NAME:

Krist Petersen

EDUCATION:

BS	(Biology), Eastern New Mexico University, Portales, New Mexico, 1973
MSEE	(Electrical Engineering), New Mexico State University, Las Cruces, New Mexico, 1986
Ph.D.	(Electrical Engineering), New Mexico State University, Las Cruces, New Mexico, 1998

ACADEMIC EXPERIENCE:

New Mexico State University, Las Cruces New Mexico, Instructor	1985–2004
New Mexico State University, Las Cruces New Mexico, Dept Head	2004–2005
New Mexico State University, Las Cruces New Mexico, Assoc Dean	2005-2011
New Mexico State University, Las Cruces New Mexico, Instructor	2011–2012

NON-ACADEMIC EXPERIENCE:

Uhur Security, Director of Computer Operations	1977-1980
Armco Security, Director of Computer Operations	1980-1983

CONSULTING, PATENTS, ETC., PROFESSIONAL REGISTRATION:

None

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:

Institute of Electrical and Electronics Engineers

American Society for Engineering Education

HONORS & AWARDS:

None

INSTITUTIONAL AND PROFESSIONAL SERVICE; PRINCIPAL PUBLICATIONS/PRESENTATIONS; PROFESSIONAL DEVELOPMENT ACTIVITIES (in last 5 years):

None- serving as Associate Dean of Engineering

COURSES TAUGHT 2011–2012:

EE 161 Computer Aided Problem Solving

EE 162 Digital Design EE 363 Computer Architecture

Name

Heather Day Pfeiffer

Education

Doctorate of Philosophy in Computer Science, NMSU 2007

Master of Science in Computer Science, NMSU 1988

Bachelor of Science in Microbiology/Biology, University of Washington, 1977

Academic experience

College Assistant Professor and Adjunct Faculty: Klipsch School of ECE (on Graduate Faculty) and Dona Ana Community College, New Mexico State University, Las Cruces, New Mexico, August 2007 - Present.

Graduate Programmer Analyst: Biology Department, New Mexico State University, Las Cruces, New Mexico, November 2002 - December 2003, February 2005 - May 2005.

Non-academic experience

Consultant: Akamai Physics, Inc., Las Cruces, New Mexico, October 2009 – Present.

New Mexico State University Staff: Provost and Faculty Senate Webmaster in Provost Office, New Mexico State University, Las Cruces, New Mexico, August 2007 - Present.

Senior Computer Scientist: Horton Technical Associates, Inc., Las Cruces, New Mexico, June 2005 - December 2006.

Certifications or professional registrations

Certified in WebCT and Blackboard and to teach online classes.

Current membership in professional organizations

Association for Computing Machinery (ACM)

IEEE Computer Society and IEEE

The American Society for Information Systems and Technology (ASIS&T)

New Mexico Network for Women in Science and Engineering (NMNWSE)

Honors and awards

Received a 14,000 dollars ONR Summer Faculty Fellowship as a Research Fellow, Dahlgren, VA, May 2011 - July 2011.

Chair of SIG-KM and Chair of Membership in association with the American Society of Information Science and Technology, ASIS&T, 2011.

Chair of SIG-KM in association with the American Society of Information Science and Technology, ASIS&T, 2009.

Service activities

NM BEST Purchasing Agent (2010), Webmaster (2010) and Scorekeeper, 2009 - Present

Publications

Pfeiffer, H.D. and E.L. Tonkin: "eTagging in Context: Information Management across Community Networks", in Dumova, T., & Fiordo, R. (Eds.). Handbook of Research on Social Interaction Technologies and Collaboration Software: Concepts and Trends. Hershey, PA: Information Science Reference. ISBN 9781605663685, IGI Global Press, July (2009).

Tonkin, E., E.M. Corrado, H.L. Moulaison, M.E.I. Kipp, A. Resmini, H.D. Pfeiffer, and Q. Zhang: "Collaborative and Social Tagging Networks", in *Ariadne, Issue 54, January* (2008).

Pfeiffer, H.D.: "The Effect of Data Structures Modifications on Algorithms for Reasoning Operations Using a Conceptual Graphs Knowledge Base", in *PhD Dissertation at New Mexico State University*, December (2007).

Pfeiffer, H.D., A. Kabbaj and D. Benn (eds.) *Second Conceptual Structures Tool Interoperability Workshop, CS-TIW 2007*. Milton Keynes, UK: Research Press International (2007).

Pfeiffer, H.D. and R.T. Hartley: "A Comparison of Different Conceptual Structures Projection Algorithms", in U. Priss, S. Polovina, and R. Hill (eds), *Conceptual Structures: Knowledge Architectures for Smart Applications, LNAI 4604, ICCS 2007*, pp. 165-178 (2007).

Pfeiffer, H.D. and J.J. Pfeiffer, Jr.: "Representation Levels Within Knowledge Representation" (position paper), in U. Priss, S. Polovina, and R. Hill (eds), *Conceptual Structures: Knowledge Architectures for Smart Applications, LNAI 4604, ICCS 2007*, pp. 484-487 (2007).

Keeler, M.A. and H.D. Pfeiffer:"Building a Pragmatic Methodology for KR Tool Research and Development," in *Conceptual Structures: Inspiration and Application, LNAI 4068, 14th International Conference on Conceptual Structures, ICCS 2006*, Aalborg, Denmark, pp. 314-330 (2006).

Professional development activities

Member of New Mexico State University Teaching Academy attending classes, and workshops and participating in mentoring and evaluation programs from August 2007 to Present.

Participated in the Peer-to-Peer assessment program to work on teaching techniques in 2009 at Dona Ana Community College.

NAME:

Nadipuram (Ram) R. Prasad

EDUCATION:

BE, Electrical Engineering, Mysore University, India, 1966

SM, Electrical & Computer Science, MIT, 1971

MSEE, Electrical & Computer Engineering, New Mexico State University, 1988

Ph.D., Electrical & Computer Engineering, New Mexico State University, 1989

ACADEMIC EXPERIENCE:

2000 - Present Director, Rio Grande Institute for Soft Computing (*RioSoft*) & *Rio*RoboLab

1995 - Present Associate Professor, NMSU, Intelligent Systems, Systems Science, Robotics

1990 - 1995 Assistant Professor, NMSU, Robotics, Power Systems, Control Systems

1986 - 1990 College Instructor, NMSU, Electric Power Systems, Intelligent Systems

NON-ACADEMIC EXPERIENCE:

2008 NASA ESMD Faculty Project Fellow, NASA/JPL, Summer 2008,

2007 NASA ESMD Faculty Project Fellow, NASA/JPL, Summer 2007

2006 NSFRO Fellow, NASA/JPL, Summer 2006

2005 Visiting Scientist, NASA/JPL, Summer 2005

2004 Senior Research Scientist, SPAWAR US Navy, Summer 2004

2001-2003 Year 2001 NAFP Fellow, Cohort 5, NASA/JPL

1976 to 1985 Senior Engineer, Manager, AEP Service Corporation, Columbus, OH

1971 to 1976 System Planning Engineer, Chas. T. Main, Inc., Boston, MA

1966 to 1967 Engineering Trainee, General Electric Company of India, India.

CERTIFICATIONS AND PROFESSIONAL REGISTRATIONS, CONSULTING, PATENTS, ETC:

"Apparatus and Methods for interpreting frequencies in environmental noise", Nadipuram R. Prasad and Jason C. King, 11/969,779, US Patent Pending

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:

Institute of Electrical and Electronics Engineers (IEEE), Senior Member

Founding Member, International Fuzzy Systems Association, Vietnam Chapter

HONORS & AWARDS:

U. S. Department of State, Fulbright U.S. Scholar Teaching Award, Vietnam, Spring 2012

NASA Administrator's Fellowship Program Achievement Award, July 2003.

Globalization Award, April 2002.

Outstanding Faculty Member Award, April 1999.

Bromilow Award for Teaching Excellence, April 1996.

INSTITUTIONAL AND PROFESSIONAL SERVICE IN THE LAST 5 YEARS:

Member Undergraduate Studies committee 2005-2006

Member Department Head Search Committee 2009-2010

Member, Graduate School Advisory Board, 2010-Present

Reviewer for the National Foundation for Science and Technology Development (NAFOSTED)

IEEE Transactions on Energy Systems paper reviewer

SMC paper reviewer

EPSR Journal paper reviewer

PRINCIPAL PUBLICATIONS:

First Course in Fuzzy Control and Neural Control, Hung T. Nguyen, Nadipuram R. Prasad, Carol L. Walker, Elbert A. Walker, CRC Press, 2002.

Nhap Mon: Trí Tuệ tinh toan (*Computational Intelligence: Introduction*), Phuong H. Nguyen, Nadipuram R. Prasad, and Phong L. Le, Nha Xuat Ban Khoa Hoc Va Ky Thuat (Publishers of Science and Technology), Hanoi, Vietnam, 2002.

Fuzzy Modeling and Control - Selected Works of Sugeno, Eds., Hung T. Nguyen, Nadipuram R. Prasad, CRC Press, 1999.

Electric Circuits, Thomas Hall, Nadipuram R. Prasad, Mehdi Anwar, Leane Roffey, NTC Publishing Group, November 1998.

Prasad, N. R., Almanza-Garcia, S., Lu, T., "Anomaly Detection", *Journal of Computers, Materials, & Continua*, CMC, vol.14, no.1, pp.1-22, 2009.

PROFESSIONAL DEVELOPMENT ACTIVITIES IN THE LAST 5 YEARS:

Research papers presented at 5 conferences

NAME:

Jaime Ramírez-Angulo

EDUCATION:

BS, Electrical and Electronics Engineering (Specialization area: Acoustics), ESIME-IPN National Polytechnic Institute , Mexico,1973

MS, Electrical Engineering (Area: Semiconductors), CINVESTAV IPN (Center for Advanced Studies of National Polytechnic Institute, Mexico 1976

Ph.D., Electrical Engineering (Area: Thin Film Microcircuits), University of Stuttgart, Stuttgart, Germany, 1982

ACADEMIC EXPERIENCE:

National Institute for Astrophysics, Optics and Electronics (INAOE), Puebla, Mexico August 1982 to August 1984

Instructor Texas A&M University, College Station, TX.

August 1984 to August 1990 Assistant Professor, New Mexico State University, 1990-94 - Associate Professor; 94- present - Professor

University of Seville, Seville, Spain May 1998 - December 1998, sabbatical.

NON-ACADEMIC EXPERIENCE:

Texas Instruments, (Summer Faculty Program) Summer 2001

Oak Ridge National Laboratory Summer Faculty Program 1997

NASA Ames Research Center Moffett Field, Mountain View CA, Summer 2004

NASA Goddard Space Center, Green Belt Maryland Summer 2006-2007

Violin Memory, Round Rock Texas January - May 2008 Senior Design Engineer

CERTIFICATIONS AND PROFESSIONAL REGISTRATIONS, CONSULTING, PATENTS, ETC.:

Farella Braun + Martel LLP. Patent Attorneys, Since September 2010, Texas Instruments, Summer 2001, 2002,NASA-Center for Autonomous Control Engineering, Consultant, 1999- 2004

US Patents:

"Integrated Circuit Fault Testing Implementing Voltage supply rail pulsing and corresponding instantaneous current response analysis," Patent 5,483,170, January 1996, Jeffrey S. Beasley, Hema Ramammurhty, Jaime Ramirez-Angulo and Mark R. DeYong

"Digitally Configurable Analog VLSI method for real time solution of partial differential equations," Patent 6,141,676 October 31, 2000, Jaime Ramirez-Angulo Mark R. DeYong

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:

Institute of Electrical and Electronics Engineers (IEEE), Fellow Member

HONORS & AWARDS:

U. S. Department of State, Border Fulbright Faculty Scholar Award, Mexico, 2009-2010, IEEE Fellow Member since 2000, Klipsch Distinguished Professor NMSU 2003, URC University Research Council for exceptional achievements in creative scholarly activities March 2002, Westhafer award for Excellence in Research and Creativity May 2002.

INSTITUTIONAL AND PROFESSIONAL SERVICE IN THE LAST 5 YEARS:

Member, Chair Promotion and tenure committee, ECE Department

Member Undergraduate Studies committee 2010

Member Department Head Search Committee 2009-2010

Chair Faculty Search Committee 2010

Member IEEE CAS Analog Signal Processing Committee since 1996

Member IEEE MWS Steering Committee since 1996

IEEE Transactions Journal paper reviewer, *IEEE ISCAS, MWS CAS* paper reviewer

PRINCIPAL PUBLICATIONS/PRESENTATIONS IN THE LAST YEAR:

"Using Floating Gate and Quasi-Floating Gate Techniques for Rail-to-Rail Tunable CMOS Transconductor Design," Jose M. Algueta Miguel, Antonio J. Lopez-Martin, Lucia Acosta, Jaime Ramírez-Angulo, and Ramón G. Carvajal, *IEEE Transactions on Circuits and Systems I.(I.F. 1.42)* In print.

"Three Novel Improved CMOS C-Multipliers," Jesus Aguado-Ruiz, Antonio J. Lopez-Martin, Jaime Ramirez-Angulo, *Intenational Journal of Circuit Theory*, (I.F. 2.0) In print

"-75 dB IM3 CMOS Gm-C VDSL Channel Filter" M. Jiménez, L. Acosta, R. G. Carvajal, A. Lopez-Martin and J. Ramírez-Angulo, *IEEE Transactions on Circuits and Systems II (I.F. 1.32) In print.*

"Micropower High Current Drive Class AB CMOS Current Feedback Operational Amplifier" L. Acosta, R. G. Carvajal, A. Lopez-Martin and J. Ramírez-Angulo, *International Journal of Circuit Theory and Design*, (I.F. 2.0) CT-09-0134, in print

"Design of Two-Stage Class AB CMOS Buffers: A Systematic Approach, ": Antonio Lopez-Martin, Jose M. Algueta, Lucia Acosta, Jaime Ramirez-Angulo, and Ramon G. Carvajal, *ETRI Journal* (I.F. 0.846) Paper RP1008-0465Title (in print)

"DC Offset Control with Application in a Zero-IF 0.18 um CMOS Bluetooth Receiver Chain" *J.A. Galan,* T. Sanchez-Rodriguez, R.G.Carvajal,A.J. Lopez-Martin and J. Ramirez-Angulo*, Analog Integrated Circuits and Signal Processing*, Vol.: 65 Issue: 1 Pages: 15-20, Oct 2010

"Highly Linear Voltage Follower Based on Local Feedback and a Cascode Transistor with Dynamic Biasing," C.I. Lujan, A. Torralba, R.G. Carvajal and J. Ramirez-Angulo. *Electronics Letters (I.F. 1.0)* Volume: 47 Issue: 4 Pages: 244-245 Feb 17 2011.

PROFESSIONAL DEVELOPMENT ACTIVITIES IN THE LAST 5 YEARS:

Research papers presented at 15 conferences

Six invited and plenary presentations.

Four short courses in Spain and Mexico

Name

Steven J. Stochaj

Education

Ph.D. Physics, University of Maryland, College Park, MD (1990)

B.A. Physics & Mathematics, Franklin and Marshall College, Lancaster, PA (1983)

Academic Appointments

Professor: New Mexico State University, 2005-Present

Associate Professor: New Mexico State University, 2001-2005

Assistant Professor: New Mexico State University, 1995-2001

College Assistant Professor: New Mexico State University, 1990-1995

NASA Graduate Research Fellow: Goddard Space Flight Center-NASA 1987-1990

Selected Publications

Electron Measurements with the High Energy Particle Calorimeter Telescope (HEPCaT), J.W. Mitchell, T. Hams, J.F. Krizmanic, A.A. Mosieev, M. Sasaki, R.E. Streitmatter, J.H. Adams, M.J. Christl, J.W. Watts, T.G. Guzik, J. Isbert, J.P. Wefel, C.B. Cosse, and S.J. Stochaj, Proceedings of the 31st ICRC, Lodz, Poland (2009) OG.1.5 Paper ID 1444.

Orbiting Astrophysical Spectrometer in Space (OASIS), Adams, J., *et al*., 37th COSPAR Scientific Assembly, Montreal, Canada, (2008), 22.

The Pamela experiment ready for flight, Adriani, O., *et al*. Nuclear Instruments and Methods in Physics Research A, 572 (2007) 471.

Cosmic-ray observations of the heliosphere with the PAMELA experiment, Casolino, M., & the PAMELA Collaboration, Advances in Space Research, 37 (2006) 1848.

Space qualification tests of the PAMELA instrument, Sparvoli, R., & the PAMELA Collaboration, Advances in Space Research, 37 (2006) 1841.

The Cosmic-Ray Electron and Positron Spectra Measured at 1 AU during Solar Minimum Activity, Boezio, M., & the WiZard Collaboration, Astrophysical Journal 533 (2000) 653.

Energy spectra of atmospheric muons measured with the CAPRICE98 balloon experiment, Boezio, M., & the WiZard Collaboration, Physical Review D, 67, (2003) 072003.

NIGHTGLOW: an instrument to measure the Earths nighttime ultraviolet glow results from the first engineering flight, Barbier, L. M., et al., Astroparticle Physics, 22 (2005) 439.

High-Energy Deuteron Measurement with the CAPRICE98 Experiment, Papini, P., & the WiZard Collaboration, Astrophysical Journal 615 (2004) 259.

Synergistic Activities

NMSU – 21st Century Aerospace Research Cluster Lead

NMSU- Roush Teaching Award

NMSU – Bromilow Research Award

NAME:

Wenxin Liu

EDUCATION:

Bachelor of Science, Industrial Automation, Northeastern University, China, 1996;

Master of Science, Control Theory and Application, Northeastern University, China, 2000;

Ph.D., Electrical Engineering, Missouri University of Science and Technology (the formerly University of Missouri at Rolla), 2005.

ACADEMIC EXPERIENCE:

New Mexico State University, Assistant Professor, Full-time, 2009–Present

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:

Institute of Electrical and Electronics Engineers

PRINCIPAL PUBLICATIONS/PRESENTATIONS IN THE LAST FIVE YEARS:

Y. Xu and W. Liu, "Novel multi agent based load restoration algorithm for microgrids," IEEE Transactions on Smart Grid (in press).

I. Chung, W. Liu, K. Schoder, D.A Cartes, "Integration of a bi-directional DC-DC converter model into a real-time system simulation of a shipboard medium voltage DC System," Electric Power Systems Research (in press).

I. Chung, W. Liu, D.A. Cartes, and S. Moon, "Control Parameter Optimization for Multiple Distributed Generators in a Microgrid Using Particle Swarm Optimization," European Transactions on Electrical Power (in press).

W. Liu, L. Liu, I. Chung, and D.A. Cartes, "Real-time particle swarm optimization based parameter identification applied to permanent magnet synchronous machine," Applied Soft Computing, vol. 11, no. 2, 2556-2564, March 2011.

J. Gong, V.V. Prabhu, and W. Liu, "Simulation-based performance comparison between assembly lines and assembly cells with real-time distributed arrival time control system," International Journal of Production Research, vol. 49, no. 5, pp. 1241-1253, March 2011.

W. Liu, I. Chung, L. Liu, S. Leng and D.A. Cartes, "Real-time particle swarm optimization based current harmonic cancellation," Engineering Applications of Artificial Intelligence, vol. 24, no. 1, pp. 132–141, February 2011.

I. Chung, W. Liu, D.A. Cartes, E.G. Collins, and S. Moon, "Control methods for inverter-interfaced distributed generators in a microgrid system," IEEE Transactions on Industry Applications, vol. 46, no 3, pp. 1078-1088, May/June 2010.

L. Liu, W. Liu, D.A. Cartes, and Il-Yop Chung, “Slow coherency and angle modulated particle swarm optimization based islanding of large scale power systems,” Advanced Engineering Informatics, vol. 23, no. 1, pp. 45-56, January 2009.

L. Liu, W. Liu, and D.A. Cartes, “Particle swarm optimization based parameter identification applied to permanent magnetic synchronous machine,” Engineering Applications of Artificial Intelligence, vol. 21, no. 7, pp. 1092-1100, October 2008.

W. Liu, J. Sarangapani, G.K. Venayagamoorthy, L. Liu, D.C. Wunsch II, M.L. Crow, and D.A. Cartes, “Decentralized neural network-based excitation control of large-scale power systems,” International Journal of Control, Automation, and Systems, vol. 5, no. 5, pp. 526-538, October 2007.

COURSES TAUGHT 2009–2010:

EE 532 Power System Stability and Transients

EE 543/493 Power Systems III

EE 531 Power Network Modeling & Computation

Appendix C: Equipment

Engineering Physics

Bachelor of Science in Engineering Physics

Self-Study Report

New Mexico State University

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 clusters – We have 15 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. 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.

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 a nice apparatus for observing the Hall Effect in a metal and also 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 a version of the "Foucault spinning mirror" apparatus for measuring the speed of light, and an optical table on which to set it up.

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.

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) detectors which are suitable for observing gamma-rays from radioactive sources, and the associated electronics.

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.

Co-60 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 Co-60.

Introductory Laboratory Equipment – We have numerous sets of lab equipment that are used to teach the introductory level physics laboratories (Phys 213L, 214L, 217L, and 315L). These include equipment for undergraduate mechanics, electricity, magnetism, optics, and thermodynamics experiments. Some of the introductory mechanics equipment developed in-house by Dr. Kanim as part of his laboratory development for Phys 213L. We pride ourselves on having hands-on laboratories for these classes rather than paper or on-line 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. Moreover, some of the physics demonstrations were build by EP students as part of the major design experience.

Appendix D: Institutional Summary

Engineering Physics

Bachelor of Science in Engineering Physics

Self-Study Report

New Mexico State University

Programs are requested to provide the following information.

The Institution

a. New Mexico State University
   Las Cruces, NM 88003-8001
   USA
   505-646-0111
   www.nmsu.edu

b. Dr. Barbara Couture, President.

c. This self-study report was prepared and submitted by Dr. Heinz Nakotte, Chair of the Engineering Physics Program Committee, Department of Physics.

d. ***New Mexico State University*** 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, New Mexico State University was once again reaccredited for the maximum period possible (10 years). At that time, the institution was commended for the contributions made by faculty and staff to teaching, research, and service; effective administration; and the significant increase in the quality and quantity of research during the past decade.

The ***College of Engineering*** is accredited by:

- Accreditation Board for Engineering and Technology- Technology Accreditation Commission (date of first accreditation: 1968)
- Accreditation Board of Engineering and Technology- 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 (NMSU) 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 state Senate. The board delegates authority for the internal management of the institution to the 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, a satellite learning center in Albuquerque, 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.

Engineering Physics is one of the programs located within the Department of Physics. The Deparment of Physics is part of NMSU’s College of Arts & Sciences, but Engineering Physics is an engineering degree, administerd by NMSU’s College of Engineering. The organization of the entire institution is shown in Diagram D.1, and the organization within the College of Engineering are shown in Diagram D.2.

The Physics Department Head is Dr. Stefan Zollner, and the Charir of the Engineering Physics Program Committee is Dr. Heinz Nakotte. The Department of Physics offers graduate (M.S. and Ph.D.) and undergraduate (B.S. and B.A.) degrees in physics, in addition the the B.S. in Engineering Physics, which is the focus of this Self-Study Report and being reviewed for re-accreditation.

Diagram D.1 – Institutional Structural Flowchart

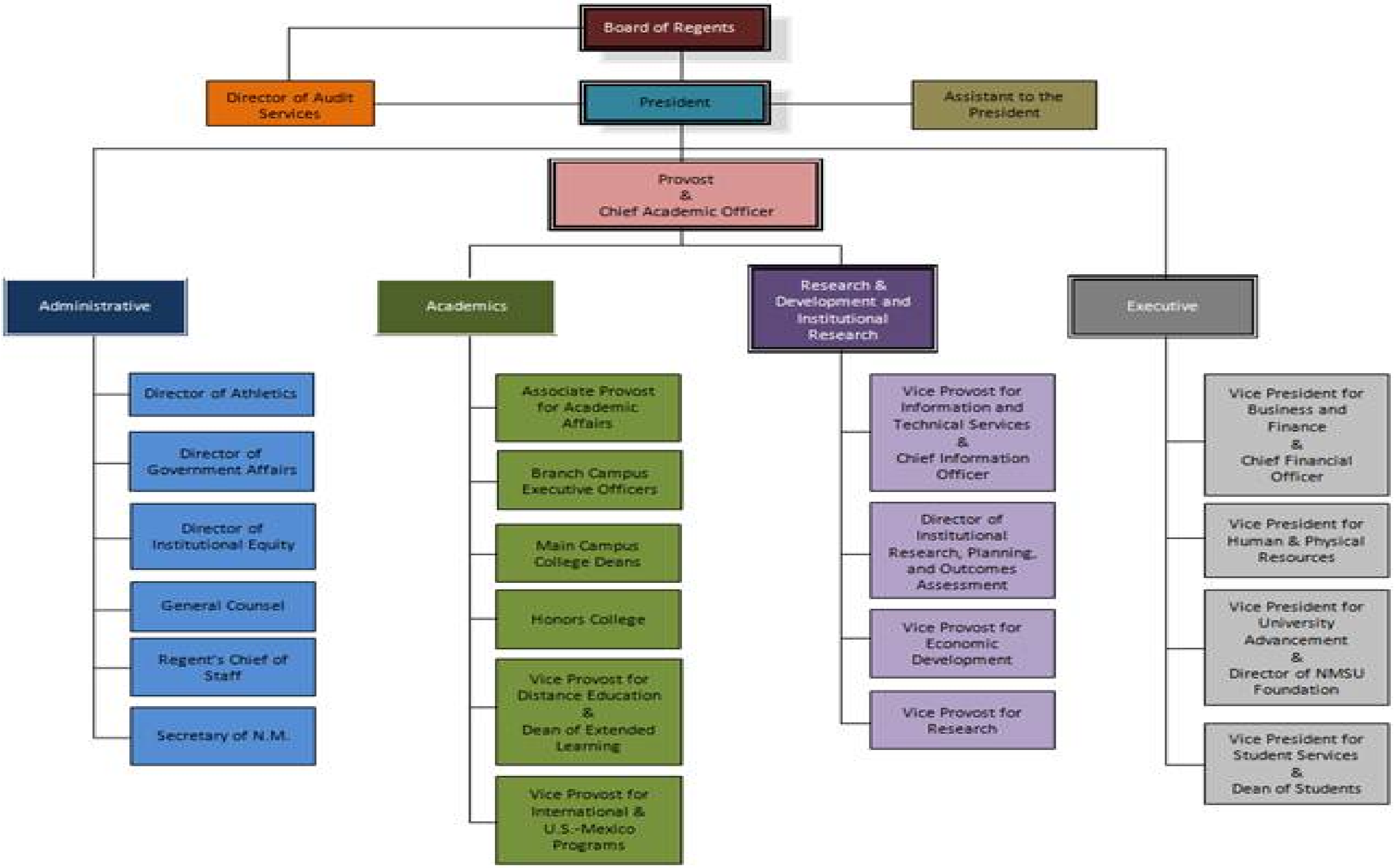
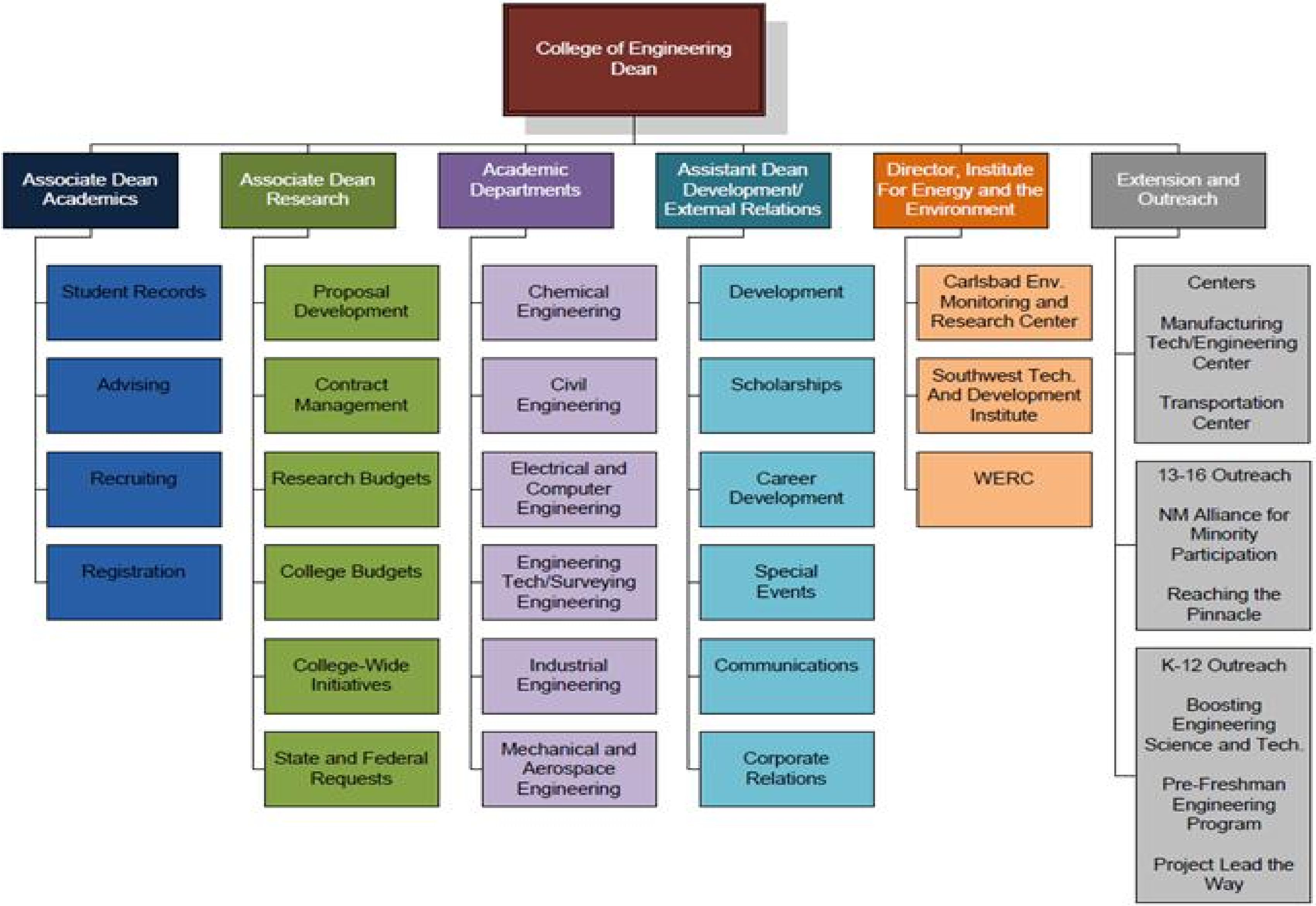


Diagram D.2. Oragnainzational Chart of the College of Engineering



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 Chemistry and Biochemistry
Dr. Michael Johnson, Academic Department Head
Email: jjohnson@nmsu.edu
Phone: (575) 646-3627

Department of Mechanical & Aerospace Engineering
Dr. Ian Leslie, Academic Department Head
Email: ileslie@nmsu.edu
Phone: (575) 646-2335

Department of Chemical Engineering
Dr. Martha Mitchell, Academic Department Head
Email: martmitc@nmsu.edu
Phone: (575) 646-3422

Department of Electrical & Computer Engineering
Dr. Satish Ranade, Academic Department Head
Email: sranadd@nmsu.edu
Phone: (575) 646-3704

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. Shaun H. Cooper, Associate Vice-President , Information Technologies
Email: socooper@nmsu.edu
Phone: (575) 646-6030

Career Services
Steven Salway, Director
Email: ssalway@nmsu.edu
Phone: (575) 646-1631

Math Success Center
Dr. Larry Hughes, Director
Email: lhughes@nmsu.edu
Phone: (575) 646-2145

Reaching the Pinnacle (RTP)
Randy Larry, Director
Email: rlarry@nmsu.edu
Phone: 575 646-2994

Security Technology Center
Program Director: Prof. Michael Morrell
Location: Engineering Complex III, Room 389
Email: mgm@nmsu.edu

New Mexico Alliance for Minority Participation (NM-AMP)
Program Director: Dr. Ricardo Jacquez
Location: Engineering Complex I, Room 106
e-mail: http://www.nmsu.edu/~nmamp/index.htm

New Mexico Space Grant Consortium
Program Director: Dr. Patricia Hynes
Location: Sugarman Space Grant Building
e-mail: http://www.nmspacegrant.com/about_us.php

GRASP (Gaining Retention and Achievement for Students Program)
Program Director: Dr. Patricia Hynes
Location: Sugarman Space Grant Building
e-mail: http://spacegrant.nmsu.edu/NMSU/fac_dev/grasp.html

Teaching Academy

Director: Dr. Tara Gray
Location: Milton Hall Room 50
http://www.teaching.nmsu.edu/People/contact.html

The Teaching Academy supports teachers, enhances learning, and builds community for NMSU educators through training, mentoring, and networking. The Teaching Academy offers:

- Workshops
- Classroom observations
- IDEA course evaluations
- Scholarships to teaching conferences
- Short courses (Teaching Scholars, Peer Coaching, Team Mentoring, Publish & Flourish, and Writing Groups)

The Teaching Academy reaches faculty and staff through 8,000 hours of training per year. At NMSU, 50% of faculty members on the Las Cruces and Doña Ana campuses participate in at least one Teaching Academy event each year. The Teaching Academy has been tasked to:

- Make Teaching Academy events more readily available to community campuses via video-streaming.
- Establish a Teaching Expo that features teaching innovations and scholarship of teaching and learning.
- Work to establish a working group of faculty on the scholarship of teaching and learning.
- Ensure that guidelines are written for all teaching awards on campus.
- Ensure that teaching and learning are more explicitly included in the next *Living the Vision* statement.

The Teaching Academy has several main initiatives besides those described above:

- Short courses
    - Peer Coaching: Teachers Helping Teachers in Classroom or Distance Education
    - Publish & Flourish: Become a Prolific Scholar
    - Writing Groups
    - Team Mentoring for Faculty New to NMSU
    - Team Mentoring for Graduate Assistants Who Teach a Class or Lab
- Classroom visitations
- Teaching conferences
- Online Newsletters

ADVANCE Program

Science Hall Room 289
Director: Pamela J. Hunt, M.A.
http://www.advance.nmsu.edu/People/contact.html

Housed within the Teaching Academy, the ADVANCE Program serves all faculty members, especially underrepresented faculty, through training, mentoring, and networking to enhance diversity and build community at NMSU. ADVANCE has the following initiatives:

- ADVANCing Leaders Program
- ADVANCE Mentoring Program
- Promotion and Tenure (P&T) Workshops
- Department Head Training
- Provide up to seven Department Head Trainings per year.
- Host two P&T workshops to 50 participants per event.
- Recruit twelve participants for ADVANCing Leaders drawn from all colleges.
- Host six ADVANCE Mentoring events per year and expand to the College of Education.
- Maintain targets for Department Head trainings, P&T programs, and ADVANCing Leaders.
- Host six ADVANCE Mentoring events per year and expand to the College of Health and Social Services.
- Maintain targets for Department Head Training, P&T programs, and ADVANCing Leaders.
- Host six ADVANCE Mentoring events per year and expand to the College of Business and the Library.

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 uses the above indicated definitions for credit units. Both, Spring and Fall semesters, deliver at least 14 weeks of classes each.

Tables

Complete the following tables for the program undergoing evaluation.

Table D.1. Engineering Physics Enrollment and Degrees Awarded

Academic Year		Enrollment						Degrees Awarded			
		Undergraduate					Graduate				
		Freshman	Sophomore	Junior	Senior	Total	Total	Associates	Bachelors	Masters	Doctorate
Fall 2011/Sp 2012	Full Time	5	8	8	10	31			4		
	Part Time	0	0	1	3	4					
Fall 2010/Sp 2011	Full Time	6	6	10	11	33			4		
	Part Time	0	0	1	1	2					
Fall 2009/Sp 2010	Full Time	7	9	1	8	25			1		
	Part Time	0	1	0	1	2					
Fall 2008/Sp 2009	Full Time	4	5	6	8	23			3		
	Part Time	0	0	0	0	0					
Fall 2007/Sp 2008	Full Time	1	5	2	5	13			2		
	Part Time	1	0	1	0	2					

Notes:
Enrollment numbers are fall term enrollment for the academic year; degrees awarded are fall and spring terms of academic year;
counts include ALL majors, regardless of primary or secondary majors;
full-time/part-time status is based on all hours enrolled by the student, regardless of the campus of enrollment

Table D.2. Personnel -Bachelor of Science in Engineering Physics

Year[1]: 2011/2012	HEAD COUNT		FTE[2]
	FT	*PT*	
Administrative[3]	0	1	0.5
Faculty (tenure-track)	13	2	14
Other Faculty (excluding student Assistants)	0	2	1
Student Teaching Assistants	14	3	15.5
Student Research Assistants	13	3	14.5
Technicians/Specialists	1	1	1.5
Office/Clerical Employees	2	0	2
Others[4]	4	2	5

[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] *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. For faculty members, 1 FTE equals what your institution defines as a full-time load.*
[3] *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.*
[4] *Specify any other category considered appropriate, or leave blank.*

Data are reported for Fall 2011 (Sept. 1st).
Graduate teaching and research assistants work 20 hours per week.
Specialist: 1 FTE lab coordinator/instructor (MS in EE)
Specilist: one graudate student for IT support (20 hours per week)
Others: Reseearch faculty, postdocs, technicians not paid by departmental I&G funds
Administrative: Department Head with 50% teaching load.

Supplementary Documentation/Information

Engineering Physics

Bachelor of Science in Engineering Physics

New Mexico State University

Degree Checklist Engineering Physics with Aerospace Concentration

Engineering Physics, Aerospace Option, 2011-2012 Catalog				
Student Name:				
Student Number:				
Catalog Year:				
Course	**Course Name**	**Credits (133)**	**Completed Grade**	**Notes**
Physics Requirements		*36*		
Phys 213	Mechanics	3		
Phys 213L	Experimental Mechanics	1		
Phys 214	Electricity and Magnetism	3		
Phys 214L	Electricity and Magnetism Laboratory	1		
Phys 217	Heat, Light, and Sound	3		
Phys 217L	Experimental Heat, Light, and Sound	1		
Phys 315	Modern Physics	3		
Phys 315L	Experimental Modern Physics	3		
Phys 395	Intermediate Mathematical Methods of Physics	3		
Phys 454	Intermediate Modern Physics I	3		
Phys 455	Intermediate Modern Physics II	3		
Phys 461	Intermediate Electricity and Magnetism I	3		
Phys 462	Intermediate Electricity and Magnetism II	3		
Phys 475	Advanced Physics Laboratory	3		
Electives		*3*		
Phys. or AE elective		3		
Aerospace Engineering Requirements		*45*		
AE 339	Aerodynamics I	3		
AE 362	Orbital Mechanics and Space Environment	3		
AE 363	Aerospace Structures	3		
AE 364	Flight Dynamics and Controls	3		
AE 419	Propulsion	3		
AE 424	Aerospace Systems Engineering	3		
AE 428	Aerospace Capstone Design	3		
AE 429	Aerodynamics II	3		

AE 447	Aerofluids Laboratory	3		
CE 301	Mechanics of Materials	3		
ME 102	Mechanical Engineering Orientation	1		
ME 159	Graphical Communication and Design	2		
ME 236	Engineering Mechanics I	3		
ME 237	Engineering Mechanics II	3		
ME 240	Thermodynamics	3		
ME 345	Experimental Methods I	3		

Math Requirements		*14*		
Math 191	Calculus and Analytic Geometry I	4		
Math 192	Calculus and Analytic Geometry II	4		
Math 291	Calculus and Analytic Geometry III	3		
Math 392	Ordinary Differential Equations	3		
Natural Science Requirement		*4*		
Chem. 111	General Chemistry I	4		
General Education Requirements		*31*		
Engl. 111G	Rhetoric and Composition	4		
Written Comm.		3		
Oral Communication		3		
Math Requirement	*(already counted in EP curriculum)*			
Natural Science I &II	*(already counted in EP curriculum)*			
Social and Behavioral Sciences		6-9		
Humanities & Fine Arts		6-9		
Viewing a Wider World I & II	*(Viewing a Wider World courses must not be in Engineering or Physics)*	6		
Final Approvals and Date	***Advisor:***			
	Department Head:			
	Dean:			

Degree Checklist Engineering Physics with Chemical Concentration

Engineering Physics, Chemical Engineering Option, 2011-2012 Catalog				
Student Name:				
Student Number:				
Catalog Year:				
Course	**Course Name**	**Credits (132)**	**Completed Grade**	**Notes**
Physics Requirements		*36*		
Phys 213	Mechanics	3		
Phys 213L	Experimental Mechanics	1		
Phys 214	Electricity and Magnetism	3		
Phys 214L	Electricity and Magnetism Laboratory	1		
Phys 217	Heat, Light, and Sound	3		
Phys 217L	Experimental Heat, Light, and Sound	1		
Phys 315	Modern Physics	3		
Phys 315L	Experimental Modern Physics	3		
Phys 451	Intermediate Mechanics	3		
Phys 454	Intermediate Modern Physics I	3		
Phys 455	Intermediate Modern Physics II	3		
Phys 461	Intermediate Electricity and Magnetism I	3		
Phys 462	Intermediate Electricity and Magnetism II	3		
Phys 475	Advanced Physics Laboratory	3		
Electives		*3*		
Phys 395 or ChE elective		3		
Chemical Engineering Requirements		*28*		
ChE 111	Computer Calculations in Ch. E.	3		
ChE 201	Material and Energy Balances	4		
ChE 301	Chemical Engineering Thermodynamics I	3		
ChE 302	Chemical Engineering Thermodynamics II	3		
ChE 305	Transport Operations I: Fluid Flow	3		
ChE 306	Transport Operations II: Heat and Mass Transfer	3		
ChE 307	Transport Operations III: Staged Operations	3		

ChE 361	Engineering Materials	3		
ChE 441	Chemical Kinetics and Reaction Engineering	3		

Math Requirements		*14*		
Math 191	Calculus and Analytic Geometry I	4		
Math 192	Calculus and Analytic Geometry II	4		
Math 291	Calculus and Analytic Geometry III	3		
Math 392	Ordinary Differential Equations	3		
Natural Science Requirements		*20*		
Chem. 115	Principles of Chemistry I	4		
Chem 116	Principles of Chemistry II	4		
Chem 313	Organic Chemistry I	3		
Chem 314	Organic Chemistry II	3		
Chem 315	Organic Chemistry Laboratory	2		
Chem 371	Analytical Chemistry	4		
General Education Requirements		*31*		
Engl. 111G	Rhetoric and Composition	4		
Written Comm.		3		
Oral Communication		3		
Math Requirement	*(already counted in EP curriculum)*			
Natural Science I &II	*(already counted in EP curriculum)*			
Social & Behav. Sci		6-9		
Humanities & Fine Arts		6-9		
Viewing a Wider World I & II	*(Viewing a Wider World courses must not be in Engineering or Physics)*	6		
Final Approvals and Date	***Advisor:***			
	Department Head:			
	Dean:			

Degree Checklist for Engineering Physics with Electrical Concentration

Engineering Physics, Electrical Option, 2011-2012 Catalog				
Student Name:				
Student Number:				
Catalog Year:				
Course	**Course Name**	**Credits (133)**	**Completed Grade**	**Notes**
Physics Requirements		*36*		
Phys 213	Mechanics	3		
Phys 213L	Experimental Mechanics	1		
Phys 214	Electricity and Magnetism	3		
Phys 214L	Electricity and Magnetism Laboratory	1		
Phys 217	Heat, Light, and Sound	3		
Phys 217L	Experimental Heat, Light, and Sound	1		
Phys 315	Modern Physics	3		
Phys 315L	Experimental Modern Physics	3		
Phys 395	Intermediate Mathematical Methods of Physics	3		
Phys 451	Intermediate Mechanics I	3		
Phys 454	Intermediate Modern Physics I	3		
Phys 455	Intermediate Modern Physics II	3		
Phys 475	Advanced Physics Laboratory	3		
Phys 480	Thermodynamics	3		
Electives		*15*		
Phys 461 & 462 or EE 310 & 351	Intermed. Elec. & Magnetism I & II or Eng. Analysis II and Applied Electromagnetics	6		
Phys. and EE electives		9		
Electrical Engineering Requirements		*33*		
EE 161	Computer-Aided Problem Solving	4		
EE 162	Digital Circuit Design	4		

EE 210	Engineering Analysis I	4		
EE 260	Embedded Systems	4		
EE 280	DC and AC Circuits	4		
EE 312	Signals and Systems I	3		
EE 380	Electronics I	4		
EE 419 or Phys 450	Capstone Design II	3		
Math Requirements		*14*		
Math 191	Calculus and Analytic Geometry I	4		
Math 192	Calculus and Analytic Geometry II	4		
Math 291	Calculus and Analytic Geometry III	3		
Math 392	Ordinary Differential Equations	3		
Other Requirements		*4*		
Chem. 111	General Chemistry I	4		
General Education Requirements		*31*		
Engl. 111G	Rhetoric and Composition	4		
Written Communication		3		
Oral Communication		3		
Math Requirement	*(already counted in EP curriculum)*			*Done*
Natural Science I &II	*(already counted in EP curriculum)*			*Done*
Social and Behavioral Sciences		6-9		
Humanities and Fine Arts		6-9		
Viewing a Wider World I & II	*(Viewing a Wider World courses must not be in Engineering or Physics)*	6		
Final Approvals and Date	***Advisor:***			
	Department Head:			
	Dean:			

Degree Checklist for Engineering Physics with Mechanical Concentration

Engineering Physics, Mechanical Option, 2011-2012 Catalog				
Student Name:				
Student Number:				
Catalog Year:				
Course	**Course Name**	**Credits (131)**	**Completed Grade**	**Notes**
Physics Requirements		*36*		
Phys 213	Mechanics	3		
Phys 213L	Experimental Mechanics	1		
Phys 214	Electricity and Magnetism	3		
Phys 214L	Electricity and Magnetism Laboratory	1		
Phys 217	Heat, Light, and Sound	3		
Phys 217L	Experimental Heat, Light, and Sound	1		
Phys 315	Modern Physics	3		
Phys 315L	Experimental Modern Physics	3		
Phys 395	Int. Mathematical Methods of Physics	3		
Phys 454	Intermediate Modern Physics I	3		
Phys 455	Intermediate Modern Physics II	3		
Phys 461	Intermediate Electricity and Magnetism I	3		
Phys 462	Intermediate Electricity and Magnetism II	3		
Phys 475	Advanced Physics Laboratory	3		
Electives		*9*		
Phys 451 or ME 333	Intermediate Mechanics or Intermediate Dynamics	3		
Phys. and EE electives		6		
Mechanical Engineering Requirements		*37*		
ME 102	Introduction to Mechanical Engineering	1		
ME 159	Graphical Communication and Design	2		
CE 301	Mechanics of Materials	3		
ME 236	Engineering Mechanics I	3		
ME 237	Engineering Mechanics II	3		
ME 240	Thermodynamics	3		

ME 260	Mechanical Engineering Problem Solving	3		
ME 328	Engineering Analysis I	3		
ME 329	Engineering Analysis II	3		
ME 338	Fluid Mechanics	3		
ME 341	Heat Transfer	3		
ME 426	Design Project Laboratory I	3		
ME 427	Design Project Laboratory II	3		
ME 449	Senior Seminar	1		
Math Requirements		*14*		
Math 191	Calculus and Analytic Geometry I	4		
Math 192	Calculus and Analytic Geometry II	4		
Math 291	Calculus and Analytic Geometry III	3		
Math 392	Ordinary Differential Equations	3		
Natural Science Requirement		*4*		
Chem. 111	General Chemistry I	4		
General Education Requirements		*31*		
Engl. 111G	Rhetoric and Composition	4		
Written Communication		3		
Oral Communication		3		
Math Requirement	*(already counted in EP curriculum)*			
Natural Science I &II	*(already counted in EP curriculum)*			
Social and Beh. Sci		6-9		
Humanities & Fine Arts		6-9		
Viewing a Wider World I & II	*(Viewing a Wider World courses must not be in Engineering or Physics)*	6		
Final Approvals and Date	***Advisor:***			
	Department Head:			
	Dean:			

Advising Form

NMSU Department of Physics
Physics Advising Form

This form is used to document undergraduate advising within the Department of Physics

Student Name: Student Banner ID:

Student E-mail: Semester advised for:

Years at NMSU or a starting date:

Degree sought: Engineering Physics EE, Engineering Physics ME, Aerospace Engineering AE, Chemical Engineering ChE, Physics BS, Physics BA

Minor degrees or other majors sought:

Expected date of graduation:

Student Progress?

Internship Experience?

Class recommendations:

Other comments:

Name of adviser and date:

Senior-Exit Interview Form

Engineering Physics
Senior Exit Interview, 2005-2006

Student Name: Interviewer:

1. Which Engineering Physics option?	A. Electrical Engineering	B. Mechanical Engineering
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 annual Quantum Times, the 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

Survey for Engineering Physics Alumni

Name:

Address:

City/State/Zip:

Home Phone:

Work Phone:

Term and year of Graduation:

Major:

1. Are you presently employed? □ Yes □ No

If yes, full time or part time? □ Full time □ Part time

If no, are you presently looking for employment? □ Yes □ No

If not employed skip to question 9

2. What is the title of your position?

What is your current salary at this position? (optional)

3. Who is your present employer?

4. How long have you worked for you present employer?

5. In your present job, how many individuals do you supervise?

6. How long did it take you 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. Please briefly describe the primary responsibilities of your job.

9. Did you pursue graduate studies after graduating from NMSU? ◻ Yes. ◻ No

If yes, where?

Did you receive a degree? ◻ Yes ◻ No

If yes, in what field and what kind of degree (e.g. MS, MBA, Ph.D., etc.)?

10. How many positions (total of employers and positions with each employer) have you held since graduating from NMSU?

11. Of these positions, how many are directly related to the training and education received in the Engineering Physics program at NMSU?

12. What would you consider as the most significant factors for success in your career?

Why:

13. Did the NMSU Engineering Physics Program achieve its Educational Objectives?

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

□ Strongly Agree □ Agree □ No Opinion □ Disagree □ Strongly Disagree

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

□ Strongly Agree □ Agree □ No Opinion □ Disagree □ Strongly Disagree

3: **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

14. I am satisfied with my overall learning experience and preparation from NMSU.

□ Strongly Agree □ Agree □ No Opinion □ Disagree □ Strongly Disagree

15. Are you a member of any professional associations? □ Yes □ No

16. Have you received, or are you in the process of pursuing any special engineering licenses or certifications? □ Yes □ No

17. What suggestions do you have for the Engineering Physics program to better prepare students for the workplace?

Written and Oral Report Forms

Project Written Report Evaluation

New Mexico State University
Department of Physics

Please score each on a scale of 0 to 10 (10 highest) and include any written comments.

Project Title:

Project Team:

Grammar, spelling, punctuation:

Appropriate length:

Structure:

Proper referencing:

Graphics:

Content:

Project Oral Report Evaluation Form

Project Oral Report Evaluation

New Mexico State University
Department of Physics

Please score each on a scale of 0 to 10 (10 highest) and include any written comments.

Project Title:

Project Team:

Verbal communication:

Visual communication:

Preparation:

Content:

Teamwork:

Teamwork Evaluation Form

Teamwork Evaluation Form

Physics Department Group Evaluation Form

Lab Class/Semester:____________________

Please write down the class you are in. The numbering of students is rand and the information is confidential, thus do NOT write your name or the names of any group members.

How much did your other group members or lab partners contribute (circle one):

Specific comments:

Student 1:
Did everything
Substantial contribution
Good contribution
Little contribution
No contribution
Disruptive

Student 2:
Did everything
Substantial contribution
Good contribution
Little contribution
No contribution
Disruptive

Student 3:
Did everything
Substantial contribution
Good contribution
Little contribution
No contribution
Disruptive

Student 4:
Did everything
Substantial contribution
Good contribution
Little contribution
No contribution
Disruptive

Student 5:
Did everything
Substantial contribution
Good contribution
Little contribution
No contribution
Disruptive

Please rate yourself in terms of your contribution:

Yourself:
I did everything
Substantial contribution
Good contribution
Little contribution
No contribution
Disruptive

Any other written comments about group performance:

Post-Course Instructor Comment Form

Post-Course Instructor Comment Form (2012 version)

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
___	___	___	___	___	___	___	_____

4. 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

☐ **projects/reports/essays**

How many (per student)? ______

☐ written ☐ oral

☐ individual ☐ group, how many group members? ____

☐ course material ☐ related material

☐ other, specify: ______________________________

☐ **class participation/attendance**

☐ attendance list

☐ in-class participation; how measured? ____

☐ other, specify: ____

☐ **other**, specify: ____

B. Textbook

Textbook used: ____

Chapters covered: __________________

- 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

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. For some courses this may include pre-tests and post-tests designed to measure the student's prerequisite knowledge or improvement. Other possible measures include embedded GRE questions in tests, evaluations of student team performance in labs, and evaluation of student presentations or projects. In case you measured other ABET outcomes as well, feel free to include them as well, but mark them with an asterisk (*). Please also append copies of any measuring tools or forms as part of this reprot

Program Outcomes	Measuring Tool (e.g.: GRE, skill-building homeworks etc.)	Target[a] (in %)	Result (in %)	Exceed Target (in %)

[a]: The target is given by: ☐ national average ☐ department avg. over last __ years plus 5%
☐ other, specify: ________________________________

E. Instructor's notes and suggestions for future course

List some possible improvements, necessary changes, suggestions and useful teaching strategies for the course in future:

____

____

____

____

____

____

____

F. Course improvements

List changes made in response to past instructor suggestions:

____

____

____

____

____

____

____

Example STAR audit

Web Audit https://aggieapps.nmsu.edu:8088/degreeaudit/servlet/ParseAuditServlet?...

OK E P Core Requirements - Courses in this requirement may
also meet Common Core requirements. See your advisor.
NO Mathematics Requirement (14 credits)
OK Natural Sciences Requirement (4 credits)
NO Physics Course Requirements (36 credits)
NO Mechanical Engineering Requirement (35 credits)
Courses in Excess of Specific Requirements
Courses not earning academic credit

*************** 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.

AT LEAST ONE REQUIREMENT HAS NOT BEEN SATISFIED

NO 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*
4.000 GPA
\+ *Total degree hours earned. (excludes developmental courses)*
125.0 CREDITS
IN-P---> 13.0 CREDITS
\- *Upper-division courses: Student must complete a mimimum*

of 48 hours at or above the 300-level.
4.0 CREDITS
+ Residency requirement: At least 30 of the last 36 degree credits must be completed at NMSU.
English Basic Skills Requirement - satisfied.
Mathematics Basic Skills Requirement - satisfied.

OK 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.
02S1 ENGL111G 3.0 CR RHETORIC/COMPOSITION
+ Complete three credits of English composition - Level 2
03SP ENGL218G 3.0 CR TCHNCL & SCNTFC CMNCTN
+ Complete three credits of oral communication.
03SP COMM253G 3.0 CR PUBLIC SPEAKING

OK General Education Common Core Area II (3 Credits) Mathematics

+ Complete 3/4 credits of college level Mathematics or higher.
03S1 MATH190G 4.0 CR TRIG & PRE-CALCULUS

OK General Education Common Core Area III (8 Credits) Laboratory Sciences

+ Chemistry:
12SP CHEM111G 4.0 A GENERAL CHEMISTRY I
+ Misc. Laboratory Sciences:
03FA C S 171 4.0 CR COMPUTER SCIENCE

NO General Education Common Core Areas IV & V (15 credits)
Social/Behavioral Sciences and Humanities/Fine Arts

Complete 6 - 9 credits in Social/Behavioral Sciences.
SELECT FROM: AG E 210, ANTH 120, 125, 201, 202, 203, C J 101, C EP 110, ECON 201, 251, 252, GEOG 112, 120 GOVT 100, 110, 150, 160, HL S 150, HON 203, HON 232, 235, 237, 248, 249, JOUR 105, LING 200, PSY 201, SOC 101, 201, S WK 221, W S 201, 202
Complete 6 - 9 credits in Humanities/Fine Arts.
SELECT FROM: ART 101, 110, 295, 296, DANC 101, ENGL 115, 116, 220, 244, HIST 101, 102, 110, 111, 112, HIST 201, 202, 211, 212, 221, 222, HON 208, 216, 220, HON 221, 222, 225, 226, 227, 228, 229, 230, 234, 239, HON 241, 242, 244, 270 MUS 101, 201, PHIL 100, 101, 124 PHIL 136, 201, 211, 223, THTR 101.

+ Social/Behavioral Sciences.
02SP PSY 201G 3.0 CR INTRDN-PSYCHOLOGY
11FA LING200G 3.0 A INTRDN TO LANGUAGE
- Humanities and Fine Arts.
03S1 PHIL201G 3.0 CR INTRN TO PHILOSOPHY
- Complete 3 credits of Social/Behavioral Science, Humanities, or Fine Arts.
NO Viewing a Wider World Requirement
Engineering Physics - Mechanical Option
Take six credits at the 300 or 400 level in General Education courses. One of the two courses must be in a department and ouside College of Arts & Sciences.
***See catalog for list of acceptable courses.**
OK E P Core Requirements - Courses in this requirement may
also meet Common Core requirements. See your advisor.
+ Complete English 111 and 218.
02S1 ENGL111G 3.0 CR RHETORIC/COMPOSITION
03SP ENGL218G 3.0 CR TCHNCL & SCNTFC CMNCTN
+ Complete MATH 191 or 192 or 291.
11FA MATH191G 4.0 A- CALCULUS I
NO Mathematics Requirement (14 credits)
- Complete the following math courses
11FA MATH191G 4.0 A- CALCULUS I
12SP MATH192G 4.0 A CALCULUS II
12FA MATH291G 3.0 IP CALCULUS III
SELECT FROM: **MATH191***, **MATH192***, **MATH392**,
OK Natural Sciences Requirement (4 credits)
+ Complete CHEM 111.
12SP CHEM111G 4.0 A GENERAL CHEMISTRY I
NO Physics Course Requirements (36 credits)
- Complete the following physics courses
11FA PHYS213 3.0 A+ MECHANICS
11FA PHYS213 L 1.0 A EXPERIMENTAL MECHANICS
12SP PHYS214 3.0 A+ ELECTRICITY/MAGNETISM
12SP PHYS214 L 1.0 A ELEC MAGNETISM LAB
12FA PHYS217 3.0 IP HEAT, LIGHT, AND SOUND
12FA PHYS217 L 1.0 IP EXP HEAT,LIGHT,SOUND
SELECT FROM: **PHYS217***, **PHYS217***, **PHYS315***, **PHYS315***, **PHYS395**, **PHYS454**, **PHYS455**, **PHYS461**, **PHYS462**, **PHYS475**,
- Complete PHYS 451 or E E 310 and M E 333.
- Complete 6 additional credits in electives in PHYS and M E.

11FA PHYS280 1.0 A INDEPENDENT STUDY
12SP PHYS280 1.0 A INDEPENDENT STUDY
SELECT FROM: **PHYS*** M E *****
NO Mechanical Engineering Requirement (35 credits)
- Complete the following mechanical engineering courses
11FA M E 102 1.0 A+ M E ORIENTATION
11FA M E 159 2.0 A+ GRPHCL CMNCTN/DESIGN
12FA M E 236 3.0 IP ENGR MECHANICS I
12FA M E 240 3.0 IP THERMODYNAMICS
SELECT FROM: **C E 301 M E 237** , **M E 261** , **M E 328** , **M E 338**,
M E 341 , **M E 426** , **M E 427** , **M E 449**,
Courses in Excess of Specific Requirements
02SP B A 104 4.0 CR INTRDN TO BUSINESS
03WI BCIS110G 4.0 CR INTRO COMPUTERIZRD INFO SYSTE
02SP C S 110G 4.0 CR COMPUTER LITERACY
12SP CHEM101 1.0 A GEN SUPPL INST I
08WI ENGL112 3.0 CR RHETORIC & COMPOSITION II
03S1 HL S355 3.0 CR RSPNDNG TO EMERGENCIES LD
03FA MATH100 E 4.0 CR MATH ELECTIVE LD
02S1 MATH180 5.0 CR TRIGONOMETRY
02S1 OECS100 E 1.0 CR OECS ELECTIVE L.D.
02S1 OECS100 E 1.0 CR OECS ELECTIVE L.D.
02S1 OECS100 E 1.0 CR OECS ELECTIVE L.D.
02FA OECS100 E 1.0 CR OECS ELECTIVE L.D.
02FA OECS100 E 1.0 CR OECS ELECTIVE L.D.
02FA OECS100 E 1.0 CR OECS ELECTIVE L.D.
03WI OECS100 E 1.0 CR OECS ELECTIVE L.D.
03SP OECS100 E 2.0 CR OECS ELECTIVE L.D.
03S1 OECS100 E 1.0 CR OECS ELECTIVE L.D.
03S1 OECS100 E 1.0 CR OECS ELECTIVE L.D.
03FA OECS100 E 4.0 CR OECS ELECTIVE L.D.
02FA OECS125 3.0 CR OPERATING SYSTEMS
02FA OECS128 1.0 CR OPR SYSTMS-LINUX/UNIX
02S1 OECS207 1.0 CR WINDOWS
02S1 OECS215 1.0 CR SPRDSHT APPLCTNS
02FA OECS230 4.0 CR DATA CMNCTN/NTWRKS I
02S1 OECS231 1.0 CR DATA CMNCTNS/NTWRK II
03WI OECS231 4.0 CR DATA CMNCTNS/NTWRK II
03SP OECS232 4.0 CR IMPLMNT/SUPRTNG NTWRKS I
03SP OECS233 4.0 CR IMPLMNT/SUPRTNG NTWRKS II
02SP OECS235 3.0 CR STRUCTURE QUERY LANG
03WI OECS255 3.0 CR SPECIAL TOPICS
02FA OECS280 1.0 CR DESKTOP PBLSHNG TECHQ

03FA P E 336 1.0 CR SCUBA DIVING LD

Courses not earning academic credit

02SP C S 100 E 0.0 NE COMPUTER SC ELECTIVE LD
02FA OECS100 E 0.0 GW OECS ELECTIVE L.D.
12SP HON 208G 0.0 W MUSIC IN TIME & SPACE
=======* LEGEND *==========================
DEGREE AUDIT CODES:
NO REQUIREMENT NOT COMPLETE }R REPEAT - GRADE IN GPA
OK REQUIREMENT COMPLETE }X REPEAT - GRADE NOT IN GPA
IP REQUIREMENT IN PROGRESS }P PLANNED COURSE GRADE IN GPA
+ SUB-REQUIREMENT COMPLETE }< ADJUSTED CREDIT OPTION
- SUB-REQUIREMENT NOT COMPLETE }S COURSE SPLIT
IN-P---> IN-PROGRESS SUMMARY }N REMEDIAL COURSE-GRADE IN GPA
* THIS AUDIT IS SUBJECT TO ADMINISTRATIVE APPROVAL *=====
AND ASSUMES IN-PROGRESS COURSES WILL BE COMPLETED SUCCESSFULLY
=========
************* NEW MEXICO STATE UNIVERSITY STAR REPORT *************

******************** END OF ANALYSIS ********************

Printer Friendly Version

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Web Audit https://aggieapps.nmsu.edu:8088/degreeaudit/servlet/ParseAuditServlet?...

Example Program Outcomes Review

Engineering Physics Outcome Assessment Report
ABET Outcome (i), Spring 2012

Prepared by: **Igor Vasiliev**

Outcome name and description
Outcome (i) **–** a recognition of the need for, and an ability to engage in lifelong learning.

Courses measuring this outcome Available reports

- PHYS 315 Modern Physics S2009, S2010, S2011, S2012
- PHYS 470 Physical Optics --
- PHYS 488 Condensed Matter Physics F2011
- PHYS 489 Introduction to Modern Materials F2006, F2008, F2009, S2011, S2012

Method of measurement
PHYS 315: In the *Modern Physics* course, the outcome (i) has been measured using a separate assessment impact in essay that students were required to write as a part of the course curriculum. Students were asked to include a brief future outlook in their essay. This part of the essay was intended to provide a measure of recognition for life-long learning. Students could get a maximum of 5 or 10 points for this portion of the essay. The benchmark for this measure was set at 80% of the maximum score (4 points out of 5, or 8 points out of 10).
PHYS 488: In the *Condensed Matter Physics* course, the outcome (i) has also been measured using a separate assessment impact in essay. The benchmark for this measure was set at 70% of the maximum score.
PHYS489: In the *Introduction to Modern Materials* course, the outcome (i) has been measured using selected homework problems or a separate assessment impact in oral presentations. The homework sets included one or more special problems designed to ascertain whether students understand the need for life-long learning. The benchmark for this measure was set at 80% of the maximum score for these problems. A part of the student's oral presentation was intended to provide a measure of recognition for life-long learning. The benchmark for this measure was set at 75% of the maximum score.
Numerical results
The numerical results for the measured outcome are shown in the attached spreadsheet. The spreadsheet shows that the average results achieved by students for the outcome (i) between 2006 and 2010 have for the most part been below the benchmark, while some of the more recent results exceeded the benchmark. The results obtained in PHYS 315 and PHYS 489 demonstrate a gradual improvement in the average student score. The average results for PHYS 315 have improved from 81% in Spring 2009 and 93% in Spring 2010 to 111% in Spring 2011. The result for PHYS 315, however, has fallen to 89% of the benchmark value in Spring 2012. The average results for PHYS 489 have increased from 78% of the benchmark value in Fall 2006 to 115% of the benchmark value in Spring 2012.

Assessment of the assessment process for this outcome

The goal of the outcome (i), “a recognition of the need for, and an ability to engage in lifelong learning ”, has been incorporated directly into the curricula of PHYS 315, PHYS 488, and PHYS 489. In my opinion, the instructors of these courses have done a very good job on the assessment of the outcome (i), especially considering the difficulty of quantitatively measuring such an inherently qualitative outcome as “life-long learning”. One issue of potential concern is the limited amount of data available for measuring the outcome (i). The only courses that measure the outcome (i) on a regular basis are PHYS 315 and PHYS 489. The majority of courses for which the outcome (i) is measured are electives that have a relatively low enrollment and may not be offered every year. Furthermore, the course PHYS 470, *Physical Optics* is being eliminated from the curriculum. This course needs to be replaced with the new course PHYS 473, *Introduction to Optics* in the EP Outcomes Matrix.

I have indicated in my previous reports that the selected benchmark for the measurement of the outcome (i) appeared to be somewhat arbitrary and that the expectation value was possibly set too high. The new data collected in 2011 and 2012 alleviate this concern to some degree, as the results achieved by the students in the most recent classes exceeded the benchmark for the outcome (i). In the future, I would recommend using statistical data from the previous years to set up a more accurate benchmark for the outcome (i).

Assessment Report for ABET Outcome (I), Spring 2012

Course	Semester	Assessment Tool	Measure	Number of Students	Result (%)	Target (%)	R/T (%)	R>T (%)
PHYS 315								
	Spring 2009	essay	separate assessment	22	65%	80%	81%	63%
	Spring 2010	essay	separate assessment	20	74%	80%	93%	55%
	Spring 2011	essay	separate assessment	25	89%	80%	111%	88%
	Spring 2012	essay	separate assessment	32	71%	80%	89%	71%
PHYS 488								
	Fall 2011	oral presentation	separate assessment	10	89%	70%	127%	100%
PHYS 489								
	Fall 2006	homework	selected problems	9	62%	80%	78%	11%
	Fall 2008	homework	selected problems	8	58%	80%	73%	25%
	Fall 2009	homework	selected problems	15	72%	80%	90%	33%
	Spring 2011	oral presentation	separate assessment	11	46%	75%	61%	n/a
	Spring 2012	oral presentation	separate assessment	5	86%	75%	115%	n/a

Engineering Physics External Advisory Board – Membership since 2005

Members of the 2011-2012 External Engineering Physics Advisory Board:

Dr. Steven Castillo, Sandia National Laboratories, Albuquerque, New Mexico
Dr. Jon Haas (Acting 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
Dr. Mark Schraad, Los Alamos National Laboratory; Los Alamos, New Mexico
Dr. John Schaub *(Alumnus)*; Valparaiso University, Indiana
Dr. Ronald Tafoya, Intel Corporation; Albuquerque, New Mexico

Members of the 2009-2010 External Engineering Physics Advisory Board:

Mr. James Christian, Engineering Physics Program Alumnus; Las Cruces, New Mexico
Dr. Candi Cook, Intel Corporation; Portland, Oregon
Mr. Jon Haas, NASA Johnson Space Center; Las Cruces, New Mexico
Prof. Mark Holtz, Texas Tech University; Lubbock, Texas
Prof. James A. McNeil, Colorado School of Mines; Golden Colorado
Dr. Mark Schraad (Chair), Los Alamos National Laboratory; Los Alamos, New Mexico
Mr. Ronald Tafoya, Intel Corporation; Albuquerque, New Mexico

Members of the 2007/2008 External Engineering Physics Advisory Board:

Mr. Jon Haas, NASA Johnson Space Center, White Sands Test Facility, Las Cruces, NM
Dr. James A. McNeil (Chair), Professor of Physics, Colorado School of Mines, Golden, CO
Dr. William Owens, Advanced Programs, Raytheon Corp., Tucson, A:Z;
Mr. Jeffery Rienstra, Systems Engineer, Sandia National Laboratory, Albuquerque, NM
Mr. John Schaub *(B.S. EP NMSU 2004*)
Dr. Mark W. Schraad, Group Leader, Fluid Dynamics, Los Alamos National Laboratory, Los Alamos, NM
Mr. Ronald Tafoya, Senior Software Engineer, Digital Health Group, Intel Corporation, Albuquerque, NM

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