2006-2007 :: B.S. in Physics

1. Mission Statement:

The mission of the B.S. degree in physics is to allow students to learn the full range of basic classical and modern physics using a hands-on approach. Students in this program develop individual creativity and expertise in physics and scientific thinking. It is expected that students in the B.S. degree program generally will continue their studies in physics or closely related programs.

2. Objectives:

2.1 Intepret behavior of energy and matter:

Be able to explain natural phenomena occurring in the physical universe in the light of the behavior of energy and matter.

2.1.1 Related General Education Outcome Item(s): 2. Mathematics; 4. Natural Science; 10. Foundational Knowledge in Discipline(s)

2.1.2 Related Strategic Plan Item(s): VI-1 K-16 Education

2.1.3 Related Institutional Priority Item(s): COM-2 Protect Enrollment Gains, Access and Student Quality as part of moving toward Tier One Status; COM-3 Sustain Progress toward Tier One Status in terms of programs, research and faculty quality

2.1.4 Student Related Objective: Yes - This is a student related objective.

2.2 Apply science based techniques for problem solving:

Be able to demonstrate the ability to apply science based techniques for solving problems related to the physical world.

2.2.1 Related General Education Outcome Item(s): 4. Natural Science; 10. Foundational Knowledge in Discipline(s)

2.2.2 Related Strategic Plan Item(s): VI-1 K-16 Education

2.2.3 Related Institutional Priority Item(s): COM-2 Protect Enrollment Gains, Access and Student Quality as part of moving toward Tier One Status; COM-3 Sustain Progress toward Tier One Status in terms of programs, research and faculty quality

2.2.4 Student Related Objective: Yes - This is a student related objective.

2.3 Discuss physical laws and theories:

Be capable of articulating physical laws and theories logically and quantitatively to facilitate entrance into professional engagement or advanced studies.

2.3.1 Related General Education Outcome Item(s): 4. Natural Science; 10. Foundational Knowledge in Discipline(s)

2.3.2 Related Strategic Plan Item(s): VI-1 K-16 Education

2.3.3 Related Institutional Priority Item(s): COM-2 Protect Enrollment Gains, Access and Student Quality as part of moving toward Tier One Status; COM-3 Sustain Progress toward Tier One Status in terms of programs, research and faculty quality

2.3.4 Student Related Objective: Yes - This is a student related objective.

2.4 Describe limitations of scientific hypotheses:

Be capable of performing experiments to test laws and hypotheses and of describing the limitations of such measurements.

2.4.1 Related General Education Outcome Item(s): 4. Natural Science; 10. Foundational Knowledge in Discipline(s)

2.4.2 Related Strategic Plan Item(s): VI-1 K-16 Education

2.4.3 Related Institutional Priority Item(s): COM-2 Protect Enrollment Gains, Access and Student Quality as part of moving toward Tier One Status; COM-3 Sustain Progress toward Tier One Status in terms of programs, research and faculty quality

2.4.4 Student Related Objective: Yes - This is a student related objective.

3. Measures & Findings:

3.1 Examniations and Student Reports:

Major Core Physics courses are: PHYS 3125 Electronics Laboratory PHYS 3311 Theoretical Physics PHYS 3312 Classical Mechanics PHYS 3325 Electronics PHYS 3330 Numerical Methods in Physics and Computational Techniques PHYS 3352 Modern Physics I PHYS 4311 Thermodynamics and Statistical Mechanics PHYS 4373 Physical

Measurements Laboratory. students will be given midterm and final exams, or required to submit lab/project reports. The data will be collected annually, or every semester the course is offered.

3.1.1 Success Criteria:

70% of the students will correctly answer 70% or more on embeded questions or score 70% or more on the exam in its entirety. Where applicable in a laboratory, 70% of student reports will demonstrate the student's facility in carrying out experiments, successfully interpreting the data and analyzing the results. Other criteria established by instructor based on the specific circumstence of the course.

3.1.2 Related Objective(s):

Intepret behavior of energy and matter; Apply science based techniques for problem solving; Discuss physical laws and theories; Describe limitations of scientific hypotheses

3.1.3 Results Related To Success Criteria: The following classes were evaluated for the Fall semester: PHYS 2125, PHYS 2325, PHYS 2326, PHYS 3125, and PHYS 3352,. Examinations were not given in 2125 and 3125 since they were lab courses.

PHYS 2125.

(1) Course Specific Objective: Be able to prepare lab reports including data, calculations, and analysis.Assessment Activity: Lab reports- Success Criteria: 85% of students will receive at least 75% partial credit on the lab reports. all lab reports.

(2) Course Specific Objective: Be able to present data graphically, statistically and analyze it. Assessment Activity: Embedded questions in labs--Success Criteria: 75% of students will receive at least 50% partial credit on the question.

(3) Course Specific Objective: Be able to classify all types of error, how to determine them and how they affect results. Assessment Activity: Embedded questions in first lab-Success Criteria: 75% of students will receive at least 50% partial credit on the question. Taking measurements and looking at error 1) Find the average, standard deviation, and standard deviation on the mean of all the lengths, widths, and heights measured and record them in Data Table II. Data Table II Statistics of Block Measurements Quantity Average Standard deviation SEOM Length Width Height Needed at least 7 out of 9 for 75% credit on table.

PHYS 2325.

Be able to interpret natural phenomena occurring in the physical universe in the light of the behavior of energy and matter.

(1) Exam #2 in its entirety, Quiz #2Homework # 7. Student will understand the different types of energy and Use the conservation of energy to work problems. 70% of students correctly work 70% of the questions.

(2) Student will understand the physics of motion in 1D, 2D and 3D (displacement, velocity, and acceleration) especially motion under conditions of constant acceleration. 70% of students scored 70% or higher.

(3) Student will understand the different types of energy and Use the conservation of energy to work problems. 70% scored 70% or higher.

PHYS2326.

(1) Be able to interpret natural phenomena occurring in the physical universe in the light of the behavior of energy and matter. Test 1; Problem 4, Test 2, Problem 1: recognize and use the concept of energy conservation in the context of the electric forces, recognize that the measurable effects of electric forces on charged particles obey the same rules as the effects of gravity on particles with mass, 75% of students scored 70% or higher75% of students scored 70% or higher.

(2) Be able to apply science based techniques for solving problems related to the physical world. Test 2, Problems 3 and 4Test 1, Problem 1 and Test 3, Problem 1 become comfortable with assessing the operation of simple electric circuits, be able to apply the superposition principle in solving problems with several field sources. 75% of students scored 70% or higher75% of students scored 70% or higher.

(3) Be capable of articulating physical laws and theories logically and quantitatively to facilitate entrance into professional engagement or advanced studies. Test problems in their entirety. Test 3, Problems 1 and 3 translate the conceptual understanding of typical problems into analytically solvable descriptions, be able to relate measurable forces on conductors driven by electrically controlled currents they carry. 75% of students scored 70% or higher75% of students scored 70% or higher.

PHYS3125.

(1) Be able to interpret natural phenomena occurring in the physical universe in the light of the behavior of energy and matter.Weekly lab reports. Basic circuit analysis tools such as Kirchhoff’s laws, mesh analysis, and phasor analysis. 60% of students score 70% or higher.

(2) Be able to apply science based techniques for solving problems related to the physical world. On site evaluation of student performance in lab. Building and testing filters, amplifiers, etc. 80% of students demonstrate competency using diagnostic equipment.

(3) Be capable of performing experiments to test laws and hypotheses and be capable of describing the limitations of such measurements. Observations of debugging protocols learned and used in laboratory circuit building

exercises. 60% of students demonstrate appropriate logic in finding and fixing circuit problems.

PHYS3352.

(1) Be capable of articulating physical laws and theories logically and quantitatively to facilitate entrance into professional engagement or advanced studies. Term paper on subject related to Modern Physics. Well written paper on a current topic related to modern physics. 80% of students correct 85% of the times or more.

3.1.4 Numerical Results:

PHYS2125: (1) 85% met expectations. (2) 78% met. (3) 85% met. PHYS2325: (1) 70%, (2) 73% (3) 70%. met the criteria of success. PHYS2326: (1) 88%, 85%. , (2)97%, 76%. , (3) 89%, 83%. met expectations. PHYS3125: (1) 70%, (2) 80%, (3) 75% met criteria. PHYS3352: (1) 80%, met.

3.1.5 Influencing Factors:

PHYS2125: upgraded lab setups, now easy to use. Experienced instructor and TAs. PHYS2325: demonstration effort by instructor who won this year's Teacher of the Year in the School of Natural Science and Math.

3.1.6 Achievement Level: Met

3.1.7 Further Action: No

3.2 Homework:

Selected core and elective courses (lists of the courses are at http://www.utdallas.edu/student/catalog/undergrad04/ugprograms/nsm-phys.html#physbs). Students will work on questions embedded in homework assignment to test students`s understanding of physics concepts. Data will be collected annually or every semester.

3.2.1 Success Criteria:

75% of students get 70% or more correct on embedded questions. Other criteria established by instructor based on the specific circumstence of the course.

3.2.2 Related Objective(s):

Intepret behavior of energy and matter; Apply science based techniques for problem solving; Discuss physical laws and theories; Describe limitations of scientific hypotheses

3.2.3 Results Related To Success Criteria: The following classes were evaluated for the Fall semester: PHYS 2125, PHYS 2325, PHYS 2326, PHYS 3125, and PHYS 3352,. Examinations were not given in 2125 and 3125 since they were lab courses.

PHYS2325.

Be able to interpret natural phenomena occurring in the physical universe in the light of the behavior of energy and matter. Homework # 7. Student will understand the different types of energy and use the conservation of energy to work problems. 70% scored 70% or higher.

3.2.4 Numerical Results: PHYS2325: 70% met.

3.2.5 Achievement Level: Met

3.2.6 Further Action: No

3.3 Quizzes:

All core and elective physics courses (http://www.utdallas.edu/student/catalog/undergrad04/ugprograms/nsm-phys.html#physbs). Students are given quizzes with embedded questions to verify that students are able to apply the concept to solve a physics problem. Data collection: Annually or every semester the course is offered. In case there are mutiple sections of same course, one of the section will be chosen.

3.3.1 Success Criteria:

75% of students will answer 70% or more of the questions correctly on embedded question. Other criteria established by instructor based on the specific circumstence of the course.

3.3.2 Related Objective(s):

Intepret behavior of energy and matter; Apply science based techniques for problem solving; Discuss physical laws and theories; Describe limitations of scientific hypotheses

3.3.3 Results Related To Success Criteria: The following classes were evaluated for the Fall semester: PHYS 2125, PHYS 2325, PHYS 2326, PHYS 3125, and PHYS 3352,. Examinations were not given in 2125 and 3125 since they were lab courses.

PHYS2325.

Be able to interpret natural phenomena occurring in the physical universe in the light of the behavior of energy and matter. Quiz #2. Student will understand the physics of motion in 1D, 2D and 3D (displacement, velocity, and acceleration) especially motion under conditions of constant acceleration. 70% of students scored 70% or higher.

3.3.4 Numerical Results: PHYS2325: 73%. Met.

3.3.5 Achievement Level: Met

3.3.6 Further Action: No

5. Closing the Loop:

5.1 Continuation of quality teaching with Physics BS program.: Continuation of quality teaching with Physics BS program. On going curriculum development, demo sets and lab experiments.

5.1.1 Related Objective(s):

Intepret behavior of energy and matter; Apply science based techniques for problem solving; Discuss physical laws and theories; Describe limitations of scientific hypotheses

5.1.2 Related Measure(s): Examniations and Student Reports; Homework; Quizzes

5.1.3 Priority: Medium Priority

6. Analysis:

6.1 Program/Unit Strengths:

6.1.1 Objectives/Outcomes Exceeded or Met: The department placed high quality instructors in the BS program and made improvement over the years. First Honors Physics I was offered with much success. Student in this class were treated to a small size class, field trip, challenging environment.

7. Report:

7.1 Executive Summary:

The faculty in the Physics Department at UT Dallas carried out an assessment of the physics degree programs in the Spring 2007 semester. Data were collected by faculty through embedded questions in exams, project reports, and examining the success rates of various goals.

We have identified the strength of the BS program: The assessment of the B.S. in Physics program is extensive and showed many strengths of the program including (1) be able to interpret natural phenomena occurring in the physical universe in the light of the behavior of energy and matter, (2)

be able to apply science based techniques for solving problems related to the physical world. (3) be capable of articulating physical laws and theories logically and quantitatively to facilitate entrance into professional engagement or advanced studies.

The assessment of this cycle showed that the learning objectives were met. Previous weakness of student learning assessed, math preparation in particular student's knowledge with linear algebra, does not appear to be a problem this semester.

There is no obvious gap to close currently. The Faculty will focus on improving the curriculum, quality og courses offered, and upgrading lab equipment and introduce new student experiments.

7.2 Top 3 Program/Unit Accomplishments: Professor Anvar Zakhidov was elected foreign member of the Russian Academy of Natural Sciences and was awarded a Kapitza medal for scientific discovery by the Russian Academy of Natural Sciences.

UTD High Energy physics began participation in the Atlas experiment currently under construction at CERN's Large Hadron Collider in Geneva, Switzerland. The Atlas experiment will explore the electroweak symmetry breaking and the origins of mass by searching for the Higgs Bosons and new physics beyond the Standard Model of Physics. The group includes two physics professors, Joseph Izen and Xinchou Lou, 1 research scientist and two graduate students.

The Physics department at UT Dallas initialized a self-study of its degree programs. The self-study document was produced during Fall 2006. The review of the Physics programs will be conducted by a committee consisting of external and UT Dallas members and has been completed in Spring 2007.

Dr. John Hoffman and his group at UT Dallas completed the design and construction of a mass spectrometer to be used in the Mars Scout Program for flights to Mars in the 2007 launch opportunity. The work was funded by NASA.

In the Spring 2007 semester Physics faculty hosted local high school students in the physics Olympics competition.

Nobel Laureate Sir Anthony James Leggett, Ph.D. in Physics, spoke to more than 1,000 high school students from science classes around the Metroplex on Thursday, March 29, 2007 at UT Dallas. Dr. Leggett delivered the Anson L. CLark Memorial Lecture titled Why Can't Time Run Backwards?" on March 30. Physics students and faculty participated actively in the organization of the program.

Physics faculty completed 2005-2006 SACS assessment.

Physics faculty Prof.s Joe Izen and John Hoffman led the advisory committee to work on the design of a $27 million building for specilized Math, Science and Engineering Education at UTD.

7.3 Research Activities or Publications:

Physics faculty at UT Dallas are active in research, teaching, scientific exchanges and pursue of research funding.

During the year 2006, 18 tenured and tenure-track faculty published more than 47 papers in referred journals, 47 conference contributed papers or abstracts, presented 60 invited conference talks and other presentations, and were funded by more than $5 million in their scientific research

7.4 Instructional/Training Activities (presented or received): The physics department, with 18 tenured and tenure-track faculty, 2 full time senior lecturers, and several part time lecturers, taught 115 organized classes and lab sections during the year 2006 (spring, summer and fall semesters). The instructors were supported by 20 teaching assistants during the long semesters (spring, fall).

During the Spring 2007 semester the Physics department taught 52 organized courses, acquired various lab equipment with the goals of developing several physics experiments illustrating the application of physics to bio/life sciences.

Dr. John Hoffman advises undergraduate students.

Dr. Greg Earle advises MS in Applied Physics students.

Dr. Roy Chaney advises Ph.D. and MS students.

The Physics undergraduate curriculum development committee, led by Dr. Joe Izen, meet twice per semester to discuss cirruculum issues and improves the UG course offering, sequence and contents.

The Physics graduate curriculum development committee, led by Dr.s Roy Chaney and Greg Earle, meet twice per semester to discuss cirruculum issues and improves the graduate course offering, sequence and contents.

In May 2007 physics faculty and staff dedicated the 3rd to a workshop at an off campus location, where they digested the results of the recently competed program review and the SACS assessment results, planned for the future in the areas of academic programs, faculty recruitment and development, students mentoring.

7.5 Public Service:

UT Dallas physics faculty advise student organizations. Dr. Xinchou Lou is the faculty adviser for Society of Physics Students; Dr.s Joe Izen and M. Urquhart are faculty adviser to Women in Physics.

The Physics Department works with Women in Physics to organize summer camps for middle school girls. This runs for 5 days and is a hands on activity from which the girls learn some basic physics.Women in Physics is a group of women in the graduate and advanced undergraduate programs in physics. It is geared toward 7th grade girls. About 20 students are in the camp each year.

The Physics Department outreach programs have included a Physic Circus that is performed both on campus in the Kusch Auditorium and at various high school and middle school sites. It consists of a series of physics demonstrations designed to attract the interest of young people and stimulate their curiosity about the world. The idea is to present the demonstrations without explanation as an entertainment feature, but with stimulation of the curiosity of the students as a learning tool. The typical show lasts about 45 minutes.

Scholars Day is a recruitment activity of the University Admissions Office. It is designed to attract prospective freshmen for the next fall's class. It is geared towards high school juniors and seniors and their parents. Activities include a popular lecture by one of the faculty, a presentation on the degrees offered, courses required, and typical schedule, and an Information Fair where students and parents can interact one-on-one with faculty. There are four Scholars Days scheduled each year.

Another outreach activity involves UTD hosting the regional Science Olympiad on March 31, 2007. The Science Olympiad is a nonprofit organization to increase student interest in science and recognize outstanding achievement in science education. This is one step in a national Science related competition for high school and junior high students. The students, their parents, and their coaches will be on campus for this event. Beatrice Rasmussen is developing the Physics Lab exercise for the high school students this year. This will consist of a lab exercise with calculations to be performed and questions to be answered.

A number of Physics faculty members have been research mentors for local high school students who participate in UTD's Clark program. These students come to UTD for several weeks of the summer and participate in research with their particular mentor. Some of these students have gone on to do their academic work at UTD and two are currently enrolled as Ph.D. Candidates.

7.6 Other External Activities:

Professor Anvar Zakhidov was elected foreign member of the Russian Academy of Natural Sciences and was awardd a Kapitza medal for scientific discovery by the Russian Academy of Natural Sciences.

UTD High Energy physics began participation in the Atlas experiment currently under construction at CERN's Large Hadron Collider in Geneva, Switzerland. The Atlas experiment will explore the electroweak symmetry breaking and the origins of mass by searching for the Higgs Bosons and new physics beyond the Standard Model of Physics. The group includes two physics professors, Joseph Izen and Xinchou Lou, 1 research scientist and two graduate students. The group is collaborating with foreign scientists on the Atlas experiment.

Dr. Brian Tinsley collaborates with scientists in Australia, England, China and Japan in his pioneering research of global warming.

7.7 Contributions to UTD:

The Physics department at UT Dallas contributes to the university in research and scholarly activities, funding and grants received, teaching services to physics students and students from other departments, public and community services, and international collaboration in research. The department also recruited Dr. KJ Cho in 2006.

During the Spring semester in 2007 faculty and teaching assistants from Physics taught over 52 courses and sections of labs. In 2006 faculty published 47 papers in referred journals and were funded by $5M of research grants and contracts. The faculty have improved the curricula and through the assessment of students learning and a self-study of Physics degree programs the department has identified the strength and weakness of the programs and developed action plan to address the weakness. The department also held discussions with other departments and school in understanding the needs of their students and purchased teaching lab equipment aimed at developing student labs demonstrating physics in its application in life sciences, medical research and engineering.

The Physics Department effort in these areas are well aligned with the university priorities:

COM-2: Protect Enrollment Gains, Access and Student Quality as part of moving toward Tier One Status

COM-3: Sustain Progress toward Tier One Status in terms of programs, research and faculty quality

7.8 Top 3 Program / Unit Challenges:

(1) The fragmentation of the Department into multiple locales has seriously reduced the ability of the faculty to collaborate and communicate amongst ourselves and with students. In 2007 the department is expected to vacate Founders building (currently main home to physics) to a unknown facility so that Founders can be renovated. It is not clear where the physics department will be housed in the future.

(2) We are understaffed with regard to teaching assistants. A typical TA assists several professors across several courses at a time.

(3) The effective size of the faculty is small and the faculty carry heavy teaching load and added administrative duties; the result is that core research areas are under critical mass and elective course offerings are limited. We will continue to work with UTD administration to expand the size of the Physics faculty by hiring the best scientists.

7.9 Detailed Resources Needed to Improve and Fulfill Mission: (1) An adequate "home" building for the Physics Department.

(2) Increase teaching assistant's stipend significantly, in order to recruit and retain quality graduate students.

(3) In the next FY, hire 2-3 top faculty in the areas of Biophysics, Nano-material Physics and Imaging Instrumentation to bring in diversified expertise among the faculty, to enrich the elective courses, both for undergraduate programs and graduate programs.

(4) Adequate M&O budget for the department to operate the academic programs. $100K/year is needed.