Institutional Effectiveness
2020-2021

Program: Physics BS

College and Department: College of Arts & Science – Department of Physics

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Mission: The mission statement for the TTU Department of Physics is to promote the learning of physics through effective teaching, research, and public service. Such learning opportunities are provided to students of all disciplines, in support of the mission of the University.

The department addresses this mission through two programs:

1. a coherent program of study leading to a B.S. in Physics, and
2. a service program that provides courses in physics and astronomy that are requirements for other degree programs or are used by students to fulfill general education science requirements.

Program Goals:

PG 1: The Department will recruit and retain sufficient majors for a thriving educational program.

Increase majors at least one per year. Having sustained an average of at least 30 majors for several years, the current minimum acceptable threshold is that the average number of majors should not drop below 30.

PG 2: The Physics Department will contribute to the mission of the Millard Oakley Center for Teaching and Learning in Science, Technology, Engineering, and Mathematics (STEM).

The majority of faculty in the department will support the center by teaching at least one class

PG 4:

SLO 5: Students graduating in physics will have received an introduction to a range of common technological tools appropriate to physics and related disciplines.

All graduating physics majors and alumni report being adequately prepared to use technological tools appropriate to physics and related disciplines in their employment or graduate studies.

SLO 6: The TTU physics program will give students sufficient preparation in content and skills/techniques to continue to graduate school or obtain suitable employment.

All graduating seniors and alumni will report being well prepared to continue on to graduate school in physics (or a closely related discipline) or to enter immediate employment, whichever is relevant to their particular situation.

SLO 7: Students graduating in physics will demonstrate the skills and techniques needed to engage in planning and carrying out basic or applied research.

Students will demonstrate competency by completing a research project in PHYS 4730

at other institutions. (Note: since almost all such experiences must necessarily take place during the summer it is impossible to ensure that all students will take advantage of such opportunities. However, the department will encourage such participation as actively as possible.) At the end of each academic year, a count is made of the number of actual or proposed p

SLO 3: Students graduating in physics will demonstrate the skills and techniques necessary to engage in authentic experimental investigation.

PHYS 4710/4711 Capstone Course: All physics majors take a senior lab course, either PHYS 4710 (4 cr) or PHYS 4711 (2 cr). To be successful in this course students must synthesize many skills

have a fresher recollection of their TTU experiences and so can provide valuable feedback on some elements of the program. The department chair already conducts a confidential exit interview with each graduating physics major. These interviews explicitly address how well prepared each student feels for their next ca

Fig 1. Number of students declaring a physics major at the start of each academic year.

PG 2: The Physics Department will contribute to the mission of the Millard Oakley Center for Teaching and Learning in Science, Technology, Engineering, and Mathematics (STEM).

Physics faculty involvement in projects and programs associated with the Millard Oakley STEM Center (MOSC) continued at a high level despite the COVID-19 pandemic. Six faculty members made use of the MOSC facilities for at least one of their courses. Two of these faculty members were also PIs on separate grants administered by MOSC. Because of the pandemic, MOSC only offered limited online outreach, and only one faculty member (and no students) was involved in these. This does meet the target for involvement of faculty, but not for students. However, given the circumstances, this is understandable.

PG 3: Ensure the use of effective and innovative pedagogical methods within the classroom.

All faculty reported that they tried at least one different strategy in their classes this year. Although much of this was as a result of the restrictions imposed by the COVID-19 pandemic, some have said that various strategies proved to be so useful that they will continue to employ them in their 'in-person' classes. Such strategies include:

- Holding virtual help sessions over Zo(e)-3 53.6 Tm0 0 0 78 Tj (i)

Fig 2. Number of undergraduate students engaged in extra-curricular research.

SLO 1: Student Learning Outcome 1 - Students completing calculus-based and algebra-based introductory physics courses will demonstrate increased understanding of foundational basic concepts in mechanics.

In the Fall 2020 all PHYS 2110 sections were delivered using a variety of hybrid or online formats. Unfortunately, only one of these sections (the one designated as officially 'online) achieved the goal of a normalized gain of 45%. The low performance of the other sections is likely attributable to both faculty and student discomfort with the delivery formats employed. For the Spring 2021 semester we used appropriate classroom spaces to revert to 'socially-distanced' in-person instruction for four sections, a fifth again being designated as 'online'. Three of the five sections surpassed the goal, with the lowest gain of 33% being attained by the online section. Folding in these results, the rolling 5-semester average gain now stands at 46%, surpassing the goal of 45% set only two years ago! Unfortunately, the disruption caused by the COVID-19 pandemic has meant that often significantly less than half the

SLO 4: Student Learning Outcome 4 - Students graduating in physics will demonstrate the ability to communicate their understanding orally in a presentation format.

Two physics majors took the PHYS 4710 course this year. Both were judged by the faculty to have made acceptable oral presentations

Modifications for Improvement:

Program Goal 1

Appendix 1: Physics BS Curriculum Map

Support for core goals and learning outcomes in the program of study for a B.S. in Physics.

Goals/Learning Outcomes