Please attach a narrative (not to exceed 4 pages, excluding appendices) addressing the following:

- **What are the student learning outcomes? Please provide a numbered list.**

  1. **Graduates of the program are expected to be successful in pursuing careers in the direct practice and application of physics or further education in more advanced programs in physics (e.g. graduate study) or related STEM fields.**

  2. **Graduates of the program are prepared to be team contributors or leaders who are capable of collaboration and independent thought.**

  3. **Graduates of the program are trained to be effective communicators (both orally and in the written word) professionally and socially.**

  4. **Graduates of the program are prepared through coursework (including online homework) and cutting-edge research to be professional problem solvers and analytical thinkers.**
5. Graduates are expected to possess the ability to work in the laboratory, understand how to record and analyze experimental data and/or generate and analyze theoretical data, and to have familiarity with practical laboratory equipment such as oscilloscopes, microscopes, power supplies, voltmeters, and spectrometers.

- Which learning outcomes were assessed? All outcomes were assessed (1-5).

- How were they assessed? (Programs must use at least one direct assessment of student learning.) Our primary tools of assessment lie in the Physics 413 (Intermediate Laboratory) and Physics 493 (Senior Thesis) courses. Performance in Physics 413 is used to assess learning outcomes 2-5. Performance in Physics 493 is used to assess learning outcomes 1-5. We also conduct an exit interview with all of our graduating students to partially-assess outcome 1 and via subsequent contact with the students after graduation.

- For the introductory laboratory courses (Phys 180L, 181L, 182L), we use a laboratory practicum exam which is 50 percent of their laboratory grade. The instructors specifically ascertain the students’ proficiency of practical laboratory skills (e.g. setting up/connecting to a circuit and reading voltage, current, and resistance values from an oscilloscope, or measuring spectral lines using a spectrometer). A small committee consisting of the Chair, laboratory coordinator Tom Hurst, and assorted faculty periodically examine the relevance of the chosen tasks that the students are asked to perform in class to judge their laboratory skills during the laboratory practicum (learning outcome 5).

- Undergraduate programs should assess at least one University Undergraduate Learning Outcome (UULO) each year, which may or may not overlap with a program learning outcome. We assess the following three UULO’s: 1. Intellectual Breadth and Lifelong Learning, 2. Inquiry and Critical Thinking, and 3. Communication.

- Graduate programs should assess at least one outcome related to one of the following graduate level requirements each year:
  6. student engagement in research, scholarship, creative expression and/or appropriate high-level professional practice.
  7. activities requiring originality, critical analysis and expertise.
  8. the development of extensive knowledge in the field under study.

Not applicable as this is an undergraduate degree.

- What was learned from the assessment results?

  The physics faculty continue to work to improve the quality and articulated expectations of Physics 493 (senior thesis). Professors who supervise students are expected to attend the oral presentations (all of them) which occur on the same day (typically the last Friday of each semester), and ask questions of the students during their presentations and shortly afterward to assess their knowledge and understanding of the subject matter they are presenting. The presentations are held consecutively (usually in the morning) for roughly 30-40 minutes each, and members of the public are invited to attend. Questions from the audience are encouraged. After the presentations are completed, the professors present remain to discuss grading in private. It is during these conversations (which of late have been more lengthy) that the faculty assess what each student learned in completing their research project, how well they communicated their results (both orally and in written form as their written reports are made available for the faculty on the prior evening if not sooner). Grades are assigned during this time by mutual agreement of the faculty present which includes the Chair of the Physics and Astronomy department (i.e. Stephen Lepp). In the opinion of the faculty, there has been consistent improvement of the quality of
Physics 493 projects and that our students are improving their ability to communicate their results (in part due to encouraging them to give practice talks beforehand) and, with better supervision, generate interesting and relevant results which inspire them to learn more. One topic discussed at length during the most recent Ph 493 presentations was how to reward students for performing research on their own initiative rather than a professor’s directive even if the research performed by the independently-minded student was not as successful as one performed by a student who was more directed by his/her advisor. We have incorporated this into the rubric.

Our department has continued instituting a policy to have the Assessment Coordinator interview all graduating undergraduates one-by-one. Questions from a standard template are asked and recorded for future analysis and faculty discussion. There is a problem that many graduating students have not seen Prof. Pravica and it is difficult for him, with all of his duties as the Physics and Astronomy’s Assessment coordinator, College of Sciences representative of the UNLV-wide Assessment committee along with his duties as a faculty member, to seek and interview these students. Both Profs. Lepp and Pravica have communicated the importance of having faculty explain to the graduating students the need to participate in the exit interviewed before leaving UNLV.

From the exit interview data gathered, students have complained about the lack of offerings of important upper-level courses that they need to graduate. This is in part due to a paucity of physics professors as a number have either retired (e.g. John Farley) or have passed away (e.g. Prof. Lon Spight and Jim Selser). There was also some criticism of the varying level of teaching and supervisory quality with some professors (allegedly) leaving class early (e.g.). As result, some students didn’t feel that they learned as much as they should have for some classes. Some students explained that they like professors who teach via the blackboard/whiteboard rather than powerpoint and use clickers which do not teach students the nuts and bolts of problem solving but rather bullet points/concepts. Some courses used math which some of students explained that they had not formally studied yet. Various textbooks were criticized as being too outdated. There were some issues pertaining to high drop out rate in certain courses taught by certain professors. In these courses, there can be (according to the students) arbitrary and spontaneous rules set by the professor in question beyond what was stated in the syllabus to such an extent that they were totally unaware of their current grade (e.g. before the drop date) leading to great stress, confusion, uncertainty, and eventually many dropping the class in question. Some of them asked for other professors to teach the required upper-division courses in question. Prof. Pravica spoke with the Chair (Stephen Lepp) about the students’s concerns and from his (Lepp’s) point of view, maintaining standards for our department was of critical importance and for the courses in question, he felt that the instructors were well suited to maintain those standards. He nevertheless agreed that it would be helpful to rotate faculty in some of the upper division required courses from time to time. He has followed through on his commitment.

On the positive side, students in general felt that by having significant research experience and exposure as an undergraduate (which is relatively unique for many large universities), they were well prepared for pursuing graduate studies and lifelong learning. All students interviewed felt that their UNLV physics education would help them succeed. In general, the students felt that their UNLV physics undergraduate education was excellent and were all largely satisfied. We also are developing a tremendous track record of having our students continue on to further their studies via graduate school (both here at UNLV and elsewhere) and/or other training.

During 2018, many of our students regularly traveled to national and international laboratories such as the Advanced Photon Source (APS), National Synchrotron Light
Source II and Canadian Light Source (CLS). Faculty members are explicitly encouraged to bring students with them to conduct experiments. In fact, due to a recent increase in HiPSEC-wide competition for beamtime at the Advanced Photon Source, faculty have a much higher chance to receive beamtime if they bring students with them. This gives faculty an incentive to involve students in research.

Unfortunately, HiPSEC did not have its funding renewed and is defunct as of December 2018. This has been a great loss to the department. We as a department have met to discuss the anticipated difficulties and challenges associated with the loss of this major funding. Prof. Pravica had separate funding from HiPSEC until last September as did other members of HiPSEC (e.g. Prof. Salmat) and they continued to involve students in research both at UNLV and at international facilities such as the APS, NSLSII and CLS. They are also aggressively seeking alternative funding sources to continue student research in condensed matter physics at UNLV. There are efforts currently underway to secure funding from various sources so that our students can travel again and be supported by fellowships or be paid to do research which will augment and amplify their knowledge and enhance their chances for success when they complete their B.Sc. in physics.

Finally, there have been discussions pertaining to physics major “ghost students” who are enrolled in the physics major but take some years to graduate bringing down the department’s graduation rate and are in sporadic contact with professors. Efforts have been made to reach out to these students.

- How did the program respond to what was learned? The Assessment coordinator has met with the Chair to discuss results of the exit interviews and discussed them at various meetings in 2018. One of our assistant professors of experimental condensed matter physicist (Ashkan Salamat) is aiding in absorbing some of the burden by teaching Physics 413 (Intermediate lab I). We are currently seeking to hire more faculty in experimental condensed matter physics and atomic molecular optics (AMO) to replace faculty who retired or recently passed away (e.g. Prof. Jim Selser) to alleviate the teaching burden.

Discussions pertaining to formally training students on public speaking and the process of researching, reading and digesting peer-reviewed papers. The late Prof. Lon Spight taught a one credit graduate-level seminar in the past but has since passed away. Prof. Salamat organizes a “Condensed Coffee” for students (mostly from his research group) where state-of-the-art research papers are presented by one of the students once a week. Prof. Steffen has also organized a similar meeting for astronomy-oriented students. HiPSEC organized a seminar every week where, barring an invited speaker, one student talks about a paper or topic during 2018. The problem with these efforts is that they are voluntary and often students don’t participate. We are actively discussing means to encourage student participation in these types of educational events. Most of our students do perform some form of research even before they take Physics 493 and most professors who take on students in their groups have regular meetings (usually weekly) with them.

Efforts have also been made to assign all physics majors to faculty advisors. Though this effort has been sporadic, we have found better success with keeping track of students and better guiding them toward earning their degrees within four years.

Please limit the narrative portion of your report to no more than four pages. You may attach appendices with data, tables, charts, or other materials as needed. Please explain the relevant conclusions from any appendices in your narrative. Please contact the Office of Academic Assessment if you have questions or need assistance.