LABORATORY AND COMPUTATIONAL PHYSICS IN THIRD-YEAR UNDERGRADUATE COURSEWORK

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Physics majors need both a strong theory foundation and exposure to practical application. Hands-on experience bridges the gap between theory and practice, allowing students to visualize abstract concepts, gain introductory insight into physics research, as well as develop critical experimental, problem-solving, and communication skills. Moreover, modern research within and beyond physics increasingly relies on computational skills, from simulating physical systems to interpreting complex datasets. To prepare physics majors with skills necessary for academic research, as well as broadly applicable skills to enhance their career prospects beyond academia, The University of Melbourne offers a research-informed subject titled '*Laboratory and Computational Physics 3'* (PHYC30021).

COURSE STRUCTURE AND ASSESSMENTS

PHYC30021 comprises 16 distinct activities covering a broad spectrum of physics disciplines. Students select four activities to complete over the semester, with each activity involving 18 contact hours. During these sessions, students work in groups of two to four to simulate the collaborative nature of scientific research. Demonstrators are also on site to provide guidance and real-time feedback. PHYC30021 is a compulsory subject for physics majors, built upon a complementary second-year subject, focused on smaller-scale experimental and computational activities. Despite the prerequisites, students enter PHYC30021 with varying levels of programming proficiency and are therefore required to attend an introductory programming session at the start of the semester. This ensures that students are equipped with relevant programming foundations to engage in more productive, physics-focused discussions with their peers.

For each activity, students submit an individual logbook and their code, where applicable. The four logbooks account for 75% of the final grade, assessed based on understanding of the material, execution of scientific methods, as well as the quality of their result presentation and analysis. Participation during contact hours is graded separately and contributes 10% to the final grade. The remaining 15% is assessed through a journal-style report based on a completed activity of their choice, to introduce students to academic writing.

IMPACT AND REFLECTION

Student Experience Surveys (SES) show that students appreciate the diversity of activities offered in PHYC30021, and the flexibility to tailor their learning experience. Students also value the unique opportunity to work on projects addressing cutting edge topics over an extended period, allowing them to thoroughly explore foundational physical concepts. Overall, students find the subject highly engaging, and particularly appreciate the immediate support provided by both their peers and demonstrators. We find that students who have taken this subject are better equipped with the foundational skills needed to undertake research in graduate programs. Anecdotally, industry-ready physics graduates have also found the experimental, computational, and communication skills developed in this subject integral to their transition into the workplace.

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