

## **Teaching Statement**

Dr. Jordan Budhu  
Postdoctoral Research Fellow and Lecturer  
Dept. Electrical Engineering and Computer Science  
University of Michigan, Ann Arbor  
Web: [www.jordanbudhu.com](http://www.jordanbudhu.com)

My teaching philosophy has one overarching theme: teaching my students to understand rather than memorize. To understand the definitions of the terms and quantities, where they are derived from, and how they are used in first principles, helps one to amalgamate these concepts into an advanced understanding. The advanced topics are applications of the fundamentals, and the fundamentals are functions of the definitions of terms and concepts. In addition, one needs a firm imagination to understand concepts. I try to encourage students to imagine more, using their minds and mental laboratories to understand and allow the mathematics of change and language of physics to unfold in their minds. For instance, the concept of a vector field is a difficult one to imagine when it is first encountered in undergraduate studies. I find it aids understanding to tell the students to imagine a room full of vectors, one at each imaginable location defined by  $x,y,z$ . Then to have them make the analogy of the “wave” in a baseball stadium and how each person does not change their  $x,y,z$  coordinates or location but simply oscillate in place. This choreographed oscillation gives rise to the propagation of a wave around the stadium. Once students understand this, they can apply it to the room full of vectors and how waves propagate within an electric field. From there, I can bring in the mathematics, and show how the mathematics support their imagination and intuition. This makes the students feel more comfortable in describing their understanding in mathematical language rather than English. Students have acknowledged that this is effective. One of the students in my undergraduate electromagnetics course wrote in his letter of recommendation for my nomination for the Excellence in Teaching Award:

“I remember the first discussion I attended that was led by Jordan Budhu. I felt exhilarated upon leaving his discussion session due to his explanations and passion for electromagnetics. That day, Jordan has us close our eyes and encourage us to imagine a room full of vectors that represented a vector field. Jordan’s ability to capture his listeners imagination using techniques similar to this while also clearly communicating the complex mathematics and physics of the field of electromagnetics is truly impressive.”

My approach to teaching is to provide the students with enough tools to understand. For example, the first is a firm understanding of the mathematical background. I first spend time in the beginning of the quarter to review the mathematics behind the concepts taught during the quarter. After the math is well understood, the concepts come easier. The second is well-prepared notes. I have found that if the students have the notes prepared in front of them, then they can spend more time listening and being engaged in the material rather than hurrying to write down the formulations. Also, in the beginning of each class, we review the previous classes materials and allow the students to come to the board to answer questions to demonstrate their knowledge. The third tool is well-prepared homework problems. These problems emulate real world engineering design and analysis problems similar to the kind they would see in industry or research. Rather than “plug and chug” type problems, I assign problems that allow creative solutions and engineering analysis and design. Each problem would also ask the students to discuss their observations and draw conclusions, which is more important than the algebraic answer,

itself. At the end of each derivation, it isn't simply enough to arrive at an answer. The final step is to provide reasoning why the student knows its correct. Supporting each problem assigned is the requirement to write computer codes to create plots or to solve parts of the problem. These are the same steps and skillsets one would need to solve engineering problems in research. In essence, the students are being taught the concepts but more importantly, trained how to become engineers and researchers. Finally, the practice solidifies the understanding of concepts and goes along with a saying my advisor used to tell us, "You don't understand something well unless you can teach it to another student." Thus, at the end of each quarter, the students prepare a small five-minute lecture about a topic and teach it on the board in front of the class.

To help students achieve this deep level of understanding, I make myself available during office hours, through email, and even outside of these hours as welcoming unscheduled office visits. Students recognize the importance of this:

"Beyond the material, Jordan is real and genuine with his students. I am continually impressed by how inviting he is to his students come visit him in his laboratory with any questions. I remember thinking there was no way that he was serious that we could drop into his laboratory without notice with questions outside his office hours. Then one day, my classmates and I were debating about a nuance of a derivation we learned during lecture that morning. We decided on a whim to just walk to Jordan's laboratory and ask him to settle our dispute. Upon arrival, I could tell that Jordan was beyond excited that we came by and within minutes he had answered all of our questions eloquently."

My goal as a teacher is not only to prepare engineers for the workforce, but to inspire and motivate. Lectures, which are still the foundation of higher education, provide me with the opportunity to do this. I want to pass on my passion for engineering to my students. I feel that a lecture is in a sense, a show, to use the historical antecedent of Sir Humphrey Davy or Michael Faraday. I want my students to enjoy coming to my lecture presentations as much as to enjoy learning the material. This commitment to well-prepared lectures pervaded my teaching at UCLA. A student wrote in their recommendation letters:

"Finally, Jordan is inspirational. Moments of silence within discussion sessions are far too common. Students become so worried that they might be embarrassed in front of their peers that they do not speak up. In these moments of silence due to the students lack of confidence, Jordan always seemed to have a 'pep talk' in store. He would remind us that we are all brilliant, and that even in few are unsure it is better to speak up and assert your thoughts with confidence. In a world of educators trying to prove how superior they are to their students; Jordan's intentions are different. You can tell he truly cares about his students. I found myself gravitating to his office hours even if I did not have questions about the class, because I knew I would just learn from being around him."

During my postdoctoral tenure at the University of Michigan, I was hired as a lecturer in the Department of Electrical Engineering and Computer Science. I taught a course in Wireless Link Design, whereby I developed all new course materials including 28 lectures, exams, homework problems and solutions, plus three all new laboratory experiments. I also contacted various outside companies requesting proposals and funding for student senior design projects that are part of the course. I carried my teaching philosophies to this course. The students gravitated toward my enthusiasm and clear explanations of the topic as evidenced in my instructor reviews:

“Professor Budhu is the most enthusiastic professor I've ever had. The posted lecture notes are very detailed and give clear explanations. I have a more rigorous understanding of material I've seen in previous classes because Professor Budhu delivers lectures in a clear, understandable manner. The homework is challenging but has helped me build intuition.”

“Professor Budhu was willing to meet with students outside of normal office hours whenever he was available to do so. He is also very helpful in office hours and very knowledgeable on antennas.”

“Professor Budhu is incredibly enthusiastic and visibly cares about teaching and our understanding of the material. The coursepack and lecture notes is a compilation of material from various textbooks and papers, so the information is presented in multiple ways which is helpful. The lectures are very comprehensive and full of information, and I make sure to attend everyone. I have also had a lot of fun so far with our project, and Professor Budhu is always available to help whenever we have questions and takes a lot of time to meet with us to work through our project.”

That semester I earned a 4.6 out of 5 average score for instructor rating. The department reassigned the course to me the following year. That semester I earned a 4.9 out of 5 average score for the instructor rating. Note, all teaching evaluations and student recommendation letters are available at [www.jordanbudhu.com](http://www.jordanbudhu.com).

In these times during a pandemic, new teaching methodologies must be envisaged. I have developed an all-new curriculum in the laboratory section to facilitate remote learning. I redesigned the labs and came up with creative ways for the students to perform the labs with equipment they could bring to their residences. Furthermore, I have reformulated the lectures such that they promote distance learning. These skills may help in the future offerings of online courses. The students have also acknowledged the effectiveness of these efforts in my most recent teaching evaluations at the University of Michigan:

“Professor Budhu acknowledges the concerns students face during an online semester in a global pandemic and the distractions they face in their study environment.”

Having the opportunity to teach as a graduate student at UCLA and as a postdoctoral researcher at the University of Michigan has inspired me to be the best teaching-scholar I can be. I look forward to implementing these goals as a faculty member in a renowned research university.