



Early Career Research Training course Winter 2018

Cal Poly Pomona

Course offered through the Achieve Scholar Program

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Office Hours: Monday 10:00-11:00 or by appointment	

Instructor: Keith Forward	email: kmforward@cpp.edu
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Office Hours: Tuesday, Thursday 10:30 – 12:00 or by appointment	

Course Description:

The focus of this course is to introduce students to a range of authentic research techniques from a broad array of disciplines. You will hone your sense of curiosity and wonder and learn to apply the methods of science and engineering to develop your own research questions and to complete an independent project. To learn the processes of science and engineering, you will participate in inquiry-based activities that will help you learn basic approaches to conducting research and will set you up to successfully complete undergraduate research outside the class. You will work in teams to decide on an independent project to pursue. You will learn to write a proposal, formulate your own research protocol, conduct a team project, and present your results.

Course organization:

The course will be team taught by and Dr. Abramzon and Dr. Forward using active, collaborative, and inquiry-based approaches known to positively influence learning. We will build on experiences and knowledge that you bring into the classroom. This will not be a passive experience but will require you to be actively engaged in the learning, as well as teaching process, by thinking, writing, speaking, and DOING science and engineering.

Course Objectives:

By the end of this course students will:

- have a high future interest in research
- have Improved self-efficacy for research
- have Increased understanding of the relevance or value of research
- appreciate the value of knowing an instruments limitations
- appreciate the value of error analysis in the context of an experiment
- have the awareness that asking your own questions and designing experiments is practices of science and engineering
- have deeper understanding of the methods and nature of science
- identify as a scientist or engineer
- pose scientific questions and design experiments to answer scientific questions.
- design experiments to reduce systematic and random errors.
- develop the habit of trying to problem solve issues on their own
- use introductory statistics to test hypotheses
- use and develop mathematical models of scientific phenomena.
- use scientific instruments and computers to gather and analyze data
- write scientific papers
- engage in peer-review of experimental questions, designs, and scientific papers
- give oral presentations of scientific work.

Requirements

- Students are required to attend ALL meetings. Absences are not acceptable. Each unexcused absence from a meeting will result in a grade reduction. See the instructor promptly with your excuse should you miss a class session.
- Showing up to class on time shows respect for your colleagues and instructors. You will lose 1% of your final grade for each 10 minutes you are late.

Academic Integrity: You are expected to observe all University rules regarding academic honesty, including but not limited to abstaining from cheating on assignments, properly referencing published written and electronic material, and only submitting work that is your own. Abuses of the University's academic integrity policy will be reported and penalties are likely to be severe. If you have any questions about what constitutes academic dishonesty, including plagiarism, please consult the University Catalog or ask us.

Deadlines: All due dates for major projects are noted on the syllabus and will not be changed. Deadlines for assignments will be announced in class. Assignments are due at the beginning of class. 10% will be deducted for each day that an assignment is late. Turning in an assignment early is always welcome!

Grading

The course grade will depend on the following elements:

<ul style="list-style-type: none">• Homework (including project memos)	15%
<ul style="list-style-type: none">• Dataset inquiry (poster presentation)	20%
<ul style="list-style-type: none">• Full Research Project<ul style="list-style-type: none">• Initial research questions (2%)• Draft research plan (5%)• Peer review of research plan (3%)• Draft of materials and methods (5%)• Draft of results and conclusions (5%)• Final presentation (10%)• Final paper (20%)	50%
<ul style="list-style-type: none">• Participation	15%

Course materials:

Marder, Michael P. *Research methods for science*. Cambridge University Press, 2011. A copy of this book is available as an ebook in the library, but only one copy can be checked out at a time so do not rely on this.

ECRT 2018 Outline of Instruction (schedule may change)

Week #	Topics	Reading To be read for the associated week	To be completed during the week, <u>due the following week</u> in class
1 Jan 1	No class, Academic Holiday acknowledged		
2 Jan 8	<ul style="list-style-type: none"> • Introduction to Inquiry • Scientific inquiry and the nature of science • Initial ideas for full research project 		<ul style="list-style-type: none"> • Initial Research Project question: Revisit and revise initial ideas for full research project. Be prepared to share specific ideas for approachable questions • Introductory Inquiry (Assignment 1.1)
3 Jan 17(you have your Mon. class on Wed.	<ul style="list-style-type: none"> • Practices of science and engineering • Introduction to scientific instrumentation <ul style="list-style-type: none"> • Calibration Methods • Peer review of experimental question for full research project 	CH 1	Draft Research Project plan: <ul style="list-style-type: none"> • revise experimental question, • propose specific methods and procedures • Meeting with peer advisor due • Project memo
4 Jan 22	<ul style="list-style-type: none"> • Introduction to Statistics • Fun with Error analysis 	Ch2 2.1.1-2.3.3 ; CH3 pp. 51-61; CH3 pp. 81-105; Appendix A OR Math and Statistics in Biology	
5 Jan 29	<ul style="list-style-type: none"> • Technical Writing • REU Discussion • Research project group work 	Ch 5 pp.151-161	<ul style="list-style-type: none"> • Lab write up <ul style="list-style-type: none"> ○ Peer review of Draft Research Project plan • Project memo
6 Feb 5	Dataset inquiry <ul style="list-style-type: none"> • Introduction and class activity 	Background papers for project	<ul style="list-style-type: none"> • Data base inquiry, prepare for presentation. • Final inquiry research plan • Work on Research Project
7 Feb 12	<ul style="list-style-type: none"> • Dataset inquiry poster presentations • Research project group work 	CH 5 (pp 152-158)	<ul style="list-style-type: none"> • Draft of introduction / materials and methods • Project memo
8 Feb 19	<ul style="list-style-type: none"> • Research project group work • Individual group meetings 		<ul style="list-style-type: none"> • Prepare for final presentation and work on research paper • Draft of results and conclusions
9 Feb 26	<ul style="list-style-type: none"> • Research Project group work • "Drop in" support in classroom 		<ul style="list-style-type: none"> • Work on Research project • Revise introduction, materials and methods • Project memo • Attend the RCSA conference (on March 2nd) and prepare a summary of "best practices" from conference
10 Mar 5	<ul style="list-style-type: none"> • Research Project group work • "Drop in" support in classroom 		<ul style="list-style-type: none"> • Revise results and conclusions • Prepare for final presentation and work on research paper
Finals March 12	Final presentation and research paper due		