**PRELIMINARY COURSE SYLLABUS 3/28/10**

**Physics 116C Spring 2010**

**Introduction to Computer-Based Experiments in Physics**


**Class meets** MWF 1:10-2:00 PM in 158 Roessler  
**Lab meets** W 3:10-6:00 PM in 152 Roessler.

<table>
<thead>
<tr>
<th>Week</th>
<th>Monday</th>
<th>Topics/Notes</th>
<th>Lab and <em>Essick (E) Chapters</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mar 29</td>
<td><strong>First day of class</strong> is Mon., March 29 Overview, LabVIEW, Statistics intro.</td>
<td>1: LabVIEW: exercises in <em>E Ch. 1,2</em></td>
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<td>2</td>
<td>Apr 5</td>
<td>Introduction to statistics (continued)</td>
<td>2: LabVIEW: exercises in <em>E Ch. 3,5,6</em></td>
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<td>3</td>
<td>Apr 12</td>
<td>Distributions; radioactive decay ( \chi^2 ) test, parameter estimation</td>
<td>3: LabVIEW Express DAQ Exercises in <em>E Ch. 4,7</em></td>
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<td>4</td>
<td>Apr 19</td>
<td>Statistics (cont.); particle detectors 25 min. Quiz 1 Friday, April 23</td>
<td>4: Geiger Counter; Counting statistics</td>
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<td>5</td>
<td>Apr 26</td>
<td>Muon lifetime; least squares fits (<em>Basic DAQ covered above in Ch. 4</em>)</td>
<td>5: Finish GC stats; [Muon lifetime; <em>E Ch. 9</em>]</td>
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| 6    | May 3  | Sampling thm., FFT, freq. spectra  
MT Exam on Friday, May 7 | 6: FFT and freq. spectra; Windowing; *E Ch. 10* |
| 7    | May 10 | Windowing, power spectrum measurement  
Noise spectra, Johnson noise | 7: Johnson Noise *E Ch. 11: DAQmx example* |
| 8    | May 17 | Transmission lines  
Signal sources, grounding, shielding | 8: Johnson Noise Lin. Least-sq fit w/ errors *E Ch. 9 plus wiki* |
| 9    | May 24 | Dig. filters, control sys.; Thermoelectricity  
**Quiz 2 on Friday, May 28** | 9: PID temp. controller *E Ch. 12* |
| 10   | May 31 | **Memorial Day holiday on Monday**  
GPIB and instrument control (*Ch. 13*)  
**Last 116C class** is Wed., June 2 | 10: PID temp. controller |

**Final Exam:** Monday, June 7, 6:00 PM – 8:00 PM
Instructor: David Pellett
Office: Rm. 337 Physics
Office Hours: TBA in Rm 152 Physics or by appointment.
E-mail: pellett (at) physics (dot) ucdavis (dot) edu
Telephone: (530) 752-1783

TA: Mark Triplett
Office Hours: TBA in Room 152 Roessler
E-mail: mttriplett (at) ucdavis (dot) edu

Texts:
Required:
Essick, Hands-On Introduction to LabVIEW for Scientists and Engineers
LabVIEW Student Edition Software (order online – see SmartSite announcement)
Bevington and Robinson, Data Reduction and Error Analysis for the Physical Sciences, 3rd Ed.

References:
Melissinos and Napolitano, Experiments in Modern Physics, 2nd Ed.
Horowitz and Hill, The Art of Electronics, 2nd Ed. (required text for Physics 116B)
Squires, Practical Physics, 4th Ed.
Johnson and Jennings, LabVIEW Graphical Programming, 3rd Ed.
Hamming, Digital Filters
Press et al., Numerical Recipes, 3rd Ed. (Chapters 12, 13, 14)
Cowan, Statistical Data Analysis
Noble, Programming Interactivity

Course Description: Physics 116C introduces techniques for making physical measurements using computer-based instrumentation. We use the LabVIEW programming system, which finds wide application in physics (and other) labs. Self-study exercises in the text by Essick using LabVIEW Student Edition software on your own computer will introduce LabVIEW in the first 6 weeks of the course. The TA will check your progress in the lab. The course will also cover statistics and analysis of data, digitized waveforms and the sampling theorem, the finite Fourier transform and spectrum analysis, electronic techniques related to data acquisition and process control, electronic noise and other issues (see course outline). A brief overview of other approaches to data acquisition and experiment control (including an Arduino sampled signal example) will be provided at the end. The lab includes physics experiments utilizing these techniques which will require complete reports. Some information on recording data in lab and making a suitable report of the experimental results (including proper graphs) is given in Part 3 of Practical Physics by Squires.

Prerequisites: Physics 9D, 116B, Math 22AB or consent of department

Grading: Quiz 1, 7%; MT, 14%; Quiz 2, 7%; Lab, 38%; HW, 10%; Final, 24%.