Introductory Physics Laboratory II (50:750:134)

Section: **Office:** **Instructor:**	**E-Mail:** **Office hours:**

Course description: The objective of this course is to expose the student with modern research practices found in physics, engineering, and many other science-related fields. In order to get you thinking like scientists the experiments in this course will take a deconstructed approach i.e. you will not be provided with step-by-step instructional guidance. The degree of freedom and difficulty will be increasing as the course progresses. The instrumentation, componentry, and software that you will be using this semester will be, in many cases, identical to that found in professional research/development facilities. Upon completion of the two-semester lab sequence, you should attain a set of skills and knowledge not typically achieved in introductory level courses.

Learning goals: The overarching goal is that at the conclusion of the lab, a student would have acquired the foundational knowledge and skills required to conduct a thought-out experiment related to the basics of electricity and magnetism. Specific goals include: (1) ability to construct an appropriate apparatus and, if need be, fabricate a component using CAD software and 3D printing, (2) select suitable sensors and understand the pros and cons of their selection, (3) carry-out statistical and regression analysis on the data acquired using MATLAB, (4) produce graphical illustrations (diagrams, tables, plots) that are effective in relating the experiment and it's results, and (5) be able to present their experimental findings in a logical manner in either written or oral form.

Co-requisites: 50:750:204 or 50:750:132, Students *not registered for lecture will be dropped from the course.*

Course outline: The course will contain two distinct phases.

Development phase, *length ~3 weeks*, during this phase you will gain familiarity with the various experimental techniques and equipment needed to carry out your experiments

- Sensors/probes (Voltage Probes, Current Probes, Light Sensors, Magnetic Field Sensors)
- Devices (Multimeters, Power Supplies, Function Generators, Oscilloscopes
- Data handling techniques, regression analysis, and statistical analysis
- Basic Numerical Simulations
- Cameras and Image analysis
- Computer aided design (CAD) and 3D printing

Investigation phase, *length ~9 weeks*, during this phase you will be challenged to devise experiments to study various physical phenomena that you will be learning about in lecture e.g.

- Electric Charge
- Electrostatic Force
- Electric Fields
- Electric Circuits
- Magnetic Fields
- Electromagnetic Induction
- Reflection of Light
- Refraction of Light
- Geometrical Optics
- Dispersion
- Interference

Assessments and Grades: Your final course grade will be determined in the following manner.

- **Attendance/participation 20%** (individual)
  - You are expected to attend every class and participate. If you do not, it will be the instructor's discretion to deduct points for that day. Only written excuses from the university will be honored.
  - Part of your participation grade will include keeping your work station and equipment organized. This will include completing a checklist of all the equipment in your work station before and after every lab.
- **Assignments 25%** (individual)
  - This includes but is not limited to homework, in-class assignments, and on-line quizzes.
- **Experiential reports 40%** (individual/group)
  - Both written and/or oral reports will be required of you during the investigation and development phases of the course.
  - Each group must include the individual members' contributions. It is expected that each member contributes equally. The instructor my deduct points from an individual group members report if their contribution is too minimal.

- **Presentation 15%** (group)
  - The lab group will choose any lab to present their experimental methods and results at the end of the semester.

A 90-100%	C 67-75%
B+ 87-89%	D 55-66%
B 80-86%	F <55%
C+ 76-79%	

Submissions and Lab Requirements: All written lab assignments must be submitted via the Canvas submission page in Portable Document Format (.pdf). Assignments submitted in .doc or .docx file formats will not be graded. Filenames should never contain spaces, and should follow the format: labtitle.firstname-lastname.pdf

Absence Policy: Each student is allowed **one** absence in which the student must notify the instructor either before or the day of the absence. In order to get credit for that week's lab or assignments, the student must complete a make-up assignment of the instructor's choice. For all subsequent absences, the student will receive a zero for that week's assignments. In the case of a multi-week lab, absences will result in the loss of percentage points on the associated lab report proportional to the time missed. In the case of extenuating circumstances that lead to long term absences, the assistance of the Dean of Students must be requested.

Academic Integrity Policy: Students are expected to be aware of Rutgers University's Academic Integrity Policy available at academicintegrity.rutgers.edu. Breaches of academic integrity can result in consequences ranging from reprimand to expulsion.

The use of cell phones is not permitted in the laboratory. It is expected that students will not disrupt class or lab in any way. If you do so, you will be asked to leave and will not be welcome back for the rest of the class period. You will receive a zero for any assignments that you missed as a result, and will be responsible for learning any missed material on your own. No cell phones may be used during any examination this includes their use as calculators. Calculators may not be shared during a quiz.