Mystery of the Physical World Laboratory – ISP209L

Spring Semester 2010
Introduction
Logistics

- Prof. Alexandra Gade
- Cheng Sun (Teaching Assistant)
- Chetan Goyal (Teaching Aide)

- Section 1: Monday, 9:10am – 12:00pm (Gade)
- Section 2: Monday, 12:40pm – 3:30pm (Gade)
- Section 3: Monday, 4:10pm – 7:00pm (Sun)

You need:

- The Course Pack and a scientific calculator (with trigonometric functions, logarithms, …)

You cannot do any Lab without the appropriate pages of the Course Pack
ISP209L on the web

- http://www.nscl.msu.edu/~gade/teaching/ISP209L/teach_index.htm

Mystery of the Physical World Lab, ISP 209L

Course Schedule

Syllabus

Instructor Information

Prof. Alexandra Gade, gade@nscl.msu.edu, 333-6441, 1 Cyclotron
Teaching Assistant Chetan Goyal

Course Description

This two-credit laboratory provides hands-on experience to discover and understand basic physical phenomena. The course is centered around a series of 12 labs covering a variety of areas including optics, mechanical systems, and electromagnetism. The teaching team consists of a Teaching Assistant (Chetan Goyal) and me (Professor Gade).

Hours

Section 1: Monday, 9:10am - 12:00pm
Section 2: Monday, 12:40pm - 3:30pm
Section 3: Monday, 4:10pm - 7:10 pm

Required Materials

Course Pack: ISP209L Course Pack, Author: Professor Stuart Termer. The Course Pack can be downloaded [here](http://www.nscl.msu.edu/~gade/teaching/ISP209L/teach_index.htm) (It is also available at the SBS for about $5.00). You must bring the corresponding pages from the Course Pack, it will not be possible to do any lab without the Course Pack.
<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Lab#</th>
<th>Title and Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mon. 01/11</td>
<td>Intro</td>
<td>Measurements - Introductory Lecture and Information</td>
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<tr>
<td>2</td>
<td>Mon. 01/18</td>
<td>Holiday</td>
<td></td>
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<tr>
<td>3</td>
<td>Mon. 01/25</td>
<td>Lab1</td>
<td>Measurements - Dice-probability vs. measurement, human reaction time</td>
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<tr>
<td>4</td>
<td>Mon. 02/01</td>
<td>Lab2</td>
<td>Measurement of g - free fall and pendulum</td>
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<tr>
<td>5</td>
<td>Mon. 02/08</td>
<td>Lab3</td>
<td>Threshold of hearing - Sound waves, decibel scale</td>
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<td>6</td>
<td>Mon. 02/15</td>
<td>Lab4</td>
<td>Cycle Power - Conservation of energy, electrical equivalent of heat</td>
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<tr>
<td>7</td>
<td>Mon. 02/22</td>
<td>Lab5</td>
<td>Rolling Cylinders and Angular Momentum - Rotational motion</td>
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<tr>
<td>8</td>
<td>Mon. 03/01</td>
<td>Lab6</td>
<td>Electronic Circuits and Magnetic Fields - Simple circuits, bar magnet and solenoids</td>
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<td>9</td>
<td>Mon. 03/08</td>
<td></td>
<td>Spring break</td>
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<tr>
<td>9</td>
<td>Mon. 03/15</td>
<td>Lab7</td>
<td>The Oscilloscope - Oscilloscope wave forms and magnetic induction</td>
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<td>10</td>
<td>Mon. 03/22</td>
<td>Lab8</td>
<td>Basic Optics - Reflection and refraction, critical angle</td>
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<td>11</td>
<td>Mon. 03/29</td>
<td>Lab9</td>
<td>Optical Interference - Single-slit diffraction, Babinet's principle</td>
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<tr>
<td>12</td>
<td>Mon. 04/05</td>
<td>Lab10</td>
<td>Multiple-slit interference - Two-slit interference, diffraction grating</td>
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<td>13</td>
<td>Mon. 04/12</td>
<td>Lab11</td>
<td>Radioactivity - Radioactive background and sources</td>
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<tr>
<td>14</td>
<td>Mon. 04/19</td>
<td>Lab12</td>
<td>Low-Temperature Physics - Light-emitting diode, superconductivity</td>
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<tr>
<td>16</td>
<td>Mon. 04/26</td>
<td>FINAL</td>
<td>Final Exam</td>
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</tbody>
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Grades

ISP209L will be graded on a fixed scale – no curve

- **Lab:** 7 points for lab report
  3 points for pre-lab quiz
  total of 10 points per Lab (max 120)
  only your best 11 Labs count!

\[
QL = \frac{(Quiz + Lab \ total \ points)}{110}
\]

- **Final Exam:** questions based on course pack and ISP209L lecture notes

\[
FE = \frac{(Final \ Exam \ percentage)}{100}
\]

<table>
<thead>
<tr>
<th>What Grade</th>
<th>%</th>
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<tbody>
<tr>
<td>90&lt;x</td>
<td>4.0</td>
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<tr>
<td>85&lt;x&lt;90</td>
<td>3.5</td>
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<td>1.0</td>
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<tr>
<td>0&lt;x&lt;50</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Total percentage=100*[(Quiz\*0.80+Final\ Exam\ percentage\/100)\*0.2]
Lab (10 points per Lab)

3 points for pre-lab quiz

• Quizzes will be conducted on the web prior to each lab using the LON-CAPA system.
• Each quiz will be opened on Wednesday morning (five days before the lab) and it will be closed Monday at 1am. You are required to log on to LON-CAPA and take the quiz somewhere in that time frame.

7 points for lab report

The perfect score of 7 for the lab reports will be based on:
1. All experimental numbers/measurements are correctly entered and the units are given if required
2. All data manipulations are done properly (summation, averages, ...)
3. All graphs are complete with properly labeled axes and data sets
4. Complete and correct answers to all questions
5. Legibility
6. Independent work if required
Quizzes – LON-CAPA Login

Enter your MSU mail id

Enter your password

Enter msu

Click or hit return
Quiz – LON-CAPA

Navigate Course Contents

Quiz 1

- Question 1
  - Open in 20 hours, 19 minutes

- Question 2
  - Open in 20 hours, 19 minutes

- Question 3
  - Open in 20 hours, 19 minutes

- Question 4
  - Open in 20 hours, 19 minutes

- Question 5
  - Open in 20 hours, 19 minutes

- Question 6
  - Open in 20 hours, 19 minutes

Syllabus
Attendance policy for the labs

• Due to scheduling constraints in Giltner 268, there will be **no opportunity to make up a missed lab under any circumstances.** Please note that your lowest lab score, e.g. zero for a missed lab, will be dropped before computing your final grade.

• In the event that **two labs are missed with legitimate excuses**, such as an extended illness, you should inform me by email (gade@msu.edu) within 48 hours of each lab. Documentation, such as a doctor's note, is required. In these cases, **the missing lab score will be replaced at the end of the semester by an average of the other scores.**

• Unexcused absences will **always** be a zero in the grade book. The same applies to cases in which a student misses a lab because he/she forgot to bring the relevant pages from the Course Pack.

• Students who arrive more than 30 minutes late will not be allowed to do the lab.
During the Labs – Science is TEAMWORK

In each section: several groups with 2-4 students

• After conducting the measurements and tabulating the data as a team, you will analyze the data independently and present the results and answer the questions in the Course Pack.

• You are encouraged to discuss the analysis and questions with your fellow group members since science is typically a collaborative effort. (Please keep in mind that the work you turn in has to be your own).

• All material, including data sheets, graphs, answers to questions, have to be prepared by each student during the lab period and everything has to be handed in for grading before leaving the lab.
Significant figures

• Any measured value is only known within the limits of experimental uncertainty
  • Uncertainty depends on apparatus, skill of experimenter, number of measurements …

• Suppose we measure the area of a table using a meter stick
  • When the smallest division is 1mm, one can argue that it would be difficult to measure any dimension of the table to better than 1mm=0.1cm=0.001m
    (you measure 90.3cm → length is probably between 90.2 and 90.4cm, we can write for our measurement: 90.3+−0.1cm)
  • Let’s say we measure 49.5+-0.1cm and 90.3+-0.1cm as width and length of the table. Your calculator gives 4469.85 cm² but the accuracy is not justified since it contains 6 significant figures, more than each of the individual measurements!

• As a “rule of thumb”, when multiplying or dividing measured values, the number of significant figures of the final result should be the same as the number of significant figures of the least accurate individual measurement. In our example, we should quote 4470 cm² (4 digits but only three significant figures!) or better $4.47 \times 10^3$ cm² to indicate that we have three significant figures only.
Significant figures
further reading

http://www.dartmouth.edu/~genchem/sigfigs.html
Units

• If we ask in a lab to measure the length of a table, a correct answer would be 90.3cm but not 90.3. Numbers without units are meaningless.
• You will lose points if you fail to give the answers with the correct units.
See you on January 25
and have a great first week of class and
an enjoyable MLK day