The University of Jordan

Accreditation & Quality Assurance Center

Course Syllabus

Course Name:
Practical Physics 4 (0352311)
1. **Course title**: Practical Physics-4

2. **Course number**: 0352311

3. **Credit hours (theory, practical)**: (0,2)
   **Contact hours (theory, practical)**: (0,6)

4. **Prerequisites/corequisites**: 0302215, 0302261

5. **Program title**: Physics

6. **Program code**: 2

7. **Awarding institution**: The University of Jordan

8. **Faculty**: Science

9. **Department**: Physics

10. **Level of course**: Third year

11. **Year of study and semester(s)**: First Semester/2016-2017

12. **Final Qualification**: BSc degree

13. **Other department(s) involved in teaching the course**: None

14. **Language of Instruction**: English

15. **Date of production/revision**: 2/5/2011

---

**16. Course Coordinator:**

Prof. Nidal M. Ershaidat  
Office #: 11  
Office hours: 11:00 – 12:00 Sunday, Tuesday; 11:00 – 12:30 Wednesday  
Phone #: 0777217322  
e-mail: n.ershaidat@ju.edu.jo

---

**17. Other instructors:**

Prof. Sami H. Mahmood  
Office #: 17  
Office hours: 11:00 – 12:00 Sunday, Tuesday; 11:00 – 12:30 Wednesday  
Phone #: 0796709673  
e-mail: s.mahmood@ju.edu.jo

---

**18. Course Description:**

At least ten experiments each of six hours per week from the following list: Frank-Hertz experiment; Thermionic emission; Characteristics of Geiger-Muller counter and the absorption of radiation; Statistical nature of nuclear counting; Millikan's oil-drop experiment; Mechanical oscillator; Photoelectric effect; Measurements of dielectric constants of liquids; Hall effect in a conductor; Diffraction grating and Balmer series; Electron diffraction; Magnetic susceptibility; Black body radiation from thermionic emission.

---

**19. Course aims and outcomes:**
A- Aims: The course contents and procedures are designed to achieve the following objectives:
1. Expose students to a wide range of knowledge in classical and modern physics.
2. Enhance students’ critical thinking.
3. Improve students’ capacity to carry out accurate experimental measurements relevant to various physical phenomena and properties of matter.
4. Train students to analyze data in pursuit of verifying known scientific facts.
5. Train students to analyze experimental uncertainties and determine the accuracy of achievable results.
6. Train students to write scientific reports.

B- Intended Learning Outcomes (ILOs): Upon successful completion of this course students will be able to ...
1. Use suitable measuring tools and make accurate measurements of physical quantities using a variety of instruments and devices.
2. Present the measurements and experimental data in suitable formats (tables, figures) for efficient analysis.
3. Analyze the experimental data to obtain results relevant to determination of the physical properties of matter and understanding the underlying physical phenomena.
4. Determine the accuracy of the achieved results within accepted experimental uncertainties.
5. Discuss the results of experimental measurements and analyses within acceptable theories and mathematical models.
6. Compare the achieved results with the theoretical and previously published experimental results and make sound conclusions.
7. Write a scientific report based on experimental data, following the elements of scientific writing methodology.
8. Determine the characteristic frequency of the free harmonic oscillator in the absence and presence of damping break currents.
9. Determine the resonance curves for the forced oscillator with and without damping currents.
10. Determine the phase shift in the harmonic motion of the forced oscillator.
11. Verify the exponential dependence of the thermionic current on filament temperature, and evaluate the work function of tungsten metal.
12. Verify Child’s law in the space-charge limited conduction region.
14. Determine the characteristics of a Geiger-Muller (G-M) counter.
15. Determine the absorption coefficients of γ-rays in a number of absorbing metals using a G-M counter.
16. Determine the range of β-particles in aluminum and the energy of the radiation.
17. Verify the wave nature of accelerated electrons.
18. Determine the main structural parameters of a crystalline solid using electron diffraction data.
19. Determine the dielectric constant of a liquid oil.
20. Verify the random nature of nuclear radiation by investigating the statistical distribution of radiation in certain limits.
21. Verify the quantum nature of atomic energy and determine the excitation energy of the lowest excited state in atomic mercury.
22. Verify the quantization of electromagnetic radiation and the dual nature of light.
23. Determine Planck’s constant and the work function of a metal using photoelectric data.
24. Determine the elementary electronic charge using Millikan oil-drop method.
25. Determine the spacing between the rulings of a diffraction grating using diffraction of visible light with known wavelength.
26. Determine the separation between the D-lines doublet in sodium.
27. Verify Balmer series in light of the quantum theory of hydrogen atomic levels.
28. Determine the wavelengths of the spectral lines of mercury.
20. Topic Outline and Schedule:

Students are grouped in groups of two students each. Each group is initially assigned an experiment to conduct in the first week, and then move to the following experiments in subsequent weeks on a rotation basis, until the ten assigned experiments are finished.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Week</th>
<th>Instructor</th>
<th>Achieved ILOs</th>
<th>Evaluation Methods</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical Oscillator</td>
<td>1</td>
<td>Sami Mahmood Nidal Ershaidat</td>
<td>1 – 10</td>
<td>Writing a scientific report, and answering test questions.</td>
<td>[1, 2]</td>
</tr>
<tr>
<td>Thermionic Emission</td>
<td>2</td>
<td>Sami Mahmood Nidal Ershaidat</td>
<td>1 – 7; 11 – 13</td>
<td>Writing a scientific report, and answering test questions.</td>
<td>[1, 3]</td>
</tr>
<tr>
<td>G-M Counter I: Absorption of Radiation</td>
<td>3</td>
<td>Sami Mahmood Nidal Ershaidat</td>
<td>1 – 7; 14 – 16</td>
<td>Writing a scientific report, and answering test questions.</td>
<td>[1, 3]</td>
</tr>
<tr>
<td>Electron Diffraction</td>
<td>4</td>
<td>Sami Mahmood Nidal Ershaidat</td>
<td>1 – 7; 17; 18</td>
<td>Writing a scientific report, and answering test questions.</td>
<td>[1, 5]</td>
</tr>
<tr>
<td>Dielectric Constant</td>
<td>5</td>
<td>Sami Mahmood Nidal Ershaidat</td>
<td>1 – 7; 19</td>
<td>Writing a scientific report, and answering test questions.</td>
<td>[1]</td>
</tr>
<tr>
<td>G-M II: Statistics of Counting</td>
<td>6</td>
<td>Sami Mahmood Nidal Ershaidat</td>
<td>1 – 7; 20</td>
<td>Writing a scientific report, and answering test questions.</td>
<td>[1, 3, 4]</td>
</tr>
<tr>
<td>Frank – Hertz Experiment</td>
<td>7</td>
<td>Sami Mahmood Nidal Ershaidat</td>
<td>1 – 7; 21</td>
<td>Writing a scientific report, and answering test questions.</td>
<td>[1, 3, 5]</td>
</tr>
<tr>
<td>Photoelectric Effect</td>
<td>8</td>
<td>Sami Mahmood Nidal Ershaidat</td>
<td>1 – 7; 22; 23</td>
<td>Writing a scientific report, and answering test questions.</td>
<td>[1, 3, 5]</td>
</tr>
<tr>
<td>Millikan Oil Drop</td>
<td>9</td>
<td>Sami Mahmood Nidal Ershaidat</td>
<td>1 – 7; 24</td>
<td>Writing a scientific report, and answering test questions.</td>
<td>[1, 3]</td>
</tr>
<tr>
<td>Diffraction Grating</td>
<td>10</td>
<td>Sami Mahmood Nidal Ershaidat</td>
<td>1 – 7; 25 – 28</td>
<td>Writing a scientific report, and answering test questions.</td>
<td>[1, 3]</td>
</tr>
</tbody>
</table>

References

21. Teaching Methods and Assignments:

Development of ILOs is promoted through the following teaching and learning methods:

1. Written and spoken instructions on data analysis and discussion, and on scientific writing.
2. Engagement of the students in setting up experiments.
3. Returning the graded lab reports to students for revision.
4. Discussion of the concepts and knowledge relevant to each experiment with the students.
5. Evaluating students' preparation and understanding underlying physics of each experiment.
6. Instructor demonstrations on carrying out accurate measurements.
7. Discussions of the experimental results with the students.

22. Evaluation Methods and Course Requirements:

Opportunities to demonstrate achievement of the ILOs are provided through the following assessment methods and requirements:

1. Students are required to get acquainted with, and arrange the experimental setup for each experiment, which is checked and discussed with the students.
2. Students are required to prepare a scientific report on each assigned experiment, which is graded and returned to the students for revision.
3. Students are required to gather experimental data and comments on the experimental procedures, as well as preliminary analysis of the data in a lab book; the students' work is later assessed.
4. The students are tested for the level of preparation to carry out the experiment at the beginning of each experimental session.
5. The students are required to sit for a final comprehensive exam covering all fields of the experimental work to make an assessment of their overall achievement.

23. Course Policies:

A- Attendance policies:
The students are not allowed to miss a class; students who miss a class, presenting an excuse, are required to make it up at a later time, or else will receive zero grade on the missed experiment.

B- Absences from exams and handing in assignments on time:
- Late submission of the reports is acceptable only upon prior agreement of the instructor; otherwise zero grade is given to the report.
- If the student misses an exam due to acceptable circumstances, the student is required to sit for a makeup exam.

C- Health and safety procedures:
- Radiation sources used are of low radioactivity, and are shielded.
- Medical care procedure by trained staff are applied when necessary.

D- Honesty policy regarding cheating, plagiarism, misbehavior:

Cheating and plagiarism are not acceptable. Zero grade is given to any report containing copied text. Also, students who commit cheating in the final exam are failed in the course, and may be subjected to other penalties depending on the circumstances and level of misconduct.

E- Grading policy:

The final grade of the students is based on 60% assigned to the scientific reports and work in the lab book, and 40%
F- Available university services that support achievement in the course:

Supporting staff consisting of a teaching assistant and technical staff is available continuously during the experimental sessions. A mechanical workshop and efficient engineering staff is also available to find solutions for problems upon occurrence.

24. Required equipment:

Full experimental setup for each experiment, including electrical and electronic components, optical components, detectors and measuring tools, telescopes, etc.

25. References:

A- Required book (s), assigned reading and audio-visuals:


B- Recommended books, materials, and media:
1. Standard undergraduate books in Solid State Physics
2. Standard undergraduate books in Modern physics and Quantum mechanics

26. Additional information:

The whole team: instructors, assistants, and technical staff worked hand-in-hand to accomplish the intended objectives of the course. Such cooperation in handling up responsibility proved efficient.