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|  | **University of Management and Technology**  **School of Science**  **Department of Physics** |

**Course Code: PH-439**

**Course Title: Advanced Physics Lab**

**Program: BS (Physics)**

**Course Outline (Spring 2022)**

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| **Lecture Schedule** | 12:30pm-1:45pm (Wednesday)  9:30 pm – 10:45 pm (Friday) | **Pre-Requisite** | N/A | |
| **Course Coordinator** | Dr. Qayyum Zafar | **Contact** | qayyum.zafar@umt.edu.pk | |
| **Course**  **Description** | Physics is concerned with the nature, properties and understanding of matter and energy in the universe. The primary method of testing whether physical theories are correct is through comparison of theoretical predictions with measurements of physical properties. Indeed, it could be said that the pursuit of ever more accurate and precise measurements is the bedrock of modern physics. The Physics Advanced Laboratory course will consist of lectures, smaller laboratory experiments, computational exercises, and, most importantly, the design and performance of complex, open-ended experiments using high-end equipment in real research laboratories. The course is designed to develop the essential scientific and laboratory techniques required by experimental physicists, as well as oral and written communication skills, self-reliance, trouble-shooting abilities and a sophisticated understanding of measurement uncertainty. | | | |
| **Text Book** | 1. Arthur Beiser, “Concepts of Modern Physics”, McGraw-Hill, 6th ed. 2002. 2. Paul A. Tipler and Ralph A. Llewellyn, “Modern Physics”, W H Freeman and Company 6th ed. 2012. 3. R. M. Eisberg and R. Resnick, “Quantum Physics of Atoms, molecules, Solids, Nuclei and Particles”, John Wiley, 2nd ed. 2002. 4. H.Mark and H.T. Olsono. Experiments in Modern Physics (McGraw-Hill). 5. A.C. Melissinos. Experiments in Modern Physics (Academic). 6. R.J. Higgings. Experimental Electronics (McGraw-Hill). | | | |
| **Assignment& Projects** | Problems will be assigned at regular intervals as an assignment. | **Quizzes** | | All quizzes will be announced well before time.  No make-ups will be offered for missed quizzes. |
| **Mid - Term**  **Examination** | A 60-minutes exam will cover all the material covered during the first 15 lectures. | **Final**  **Examination** | | A 120-minutes exam will cover all the material covered during the semester. |
| **Attendance**  **Policy** | Students missing more than 20% of the lectures will receive an “SA” grade in the course and will not be allowed to take final exam. | | | |
| **Grading**  **Policy** | Assignment and Quizzes: 25%  Mid-Term Examination: 25%  Final Examination: 50% | | | |

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Advance Physics Lab (PH-439)

**Learning Objective:**

**Course Description:**

1. To expose the students to the advanced level experimentation in Physics
2. To make them familiar to such experiments whose outcome can be used in developing future research capabilities and teaching skills.
3. To make the students confident in their studies by showing and measuring parameter which they have used in theoretical work.

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| **S No** | **CLO Statement** | **PLO** | **Learning Domain and level** |
|  | Evaluate the process and outcomes of an experiment quantitatively and qualitatively. | 2 | C1 |
|  | Collect data and perform experimental procedure iteratively, collaboratively, reflectively and ethically. | 4 | C2 |
|  | Extend the scope of an investigation whether or not results come out as expected. | 9 | C3 |

1. **CLO – PLO MAPPING:**

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| **CLOs** | **PLOs** | | | | | | | | | | | |
| Scientific Knowledge | Problem Analysis | Conduct investigations of complex physics problems | Design / Development of Solutions | Science and Society | Environment and Sustainability | Ethics | Communication | Individual and Team Work | Lifelong Learning | Future Employability | Competency |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 1 |  | **C1** |  |  |  |  |  |  |  |  |  |  |
| 2 |  |  |  | **C2** |  |  |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |  |  | **C3** |  |  |  |

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**List of Experiments:**

1. **Solution of an Equation by Numerical Method-I**

The purpose of this exercise is to learn about the techniques used in numerical method of solution of an equation. Computer aided method is used.

1. **Solution of an Equation by Numerical Method-II**

The purpose of this exercise is to learn about the use of Newton Raphson method which is a numerical method of solution of an equation. Computer aided method is used.

1. **Measurements and Error Analysis**

The objective is to learn how to calculate error (or uncertainty) in a measurement of a parameter that depends on number of different functions.

1. **Introduction to Vacuum Technology**

In the proposed experiment, direct quantitative measurements can be obtained during the experimental work, rather than just the simple operation of vacuum systems.

1. **Study of Hall Effect**

Determine the Hall coefficient and the number density of majority charge carriers in a semiconductor sample.

1. **Measurement of Ionization Potential of Mercury.**

To measure the ionization potential of mercury.

1. **Capacitance and the Oscilloscope**

The purpose of this experiment is to investigate a capacitor as it charges and discharges at DC. You will also learn to one of the most useful piece of equipment: The oscilloscope

1. **Study of Franck‐Hertz Experiment**

To measure the excitation potential of Argon using Franck-Hertz apparatus.

**Books Recommended:**

1. H.Mark and H.T. Olsono. Experiments in Modern Physics (McGraw-Hill).
2. A.C. Melissinos. Experiments in Modern Physics (Academic).

3 R.J. Higgings. Experimental Electronics (McGraw-Hill).

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**Lecture Plan (Spring 2022)**

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| --- | --- | --- |
| **Week** | **TOPICS** | **Exp** |
| 1 | Theory about Frank-Hertz Experiment | 1 |
| 2 | Performance of experiment, Frank-Hertz Experiment | 1 |
| 3 | Non absorbing thin film on a transparent substrate | 2 |
| 4 | Non absorbing thin film on a transparent substrate error analysis | 2 |
| 5 | Theory about Measurement of Ionization Potential of mercury | 3 |
| 6 | Performance of Measurement of Ionization Potential of mercury  Viva | 3 |
| 7 | Study of Hall Effect | 4 |
| 8 | Performance of Hall Effect  Viva | 4 |
| 9 | Capacitance and Oscilloscope | 5 |
| 10 | Performance of Capacitance and Oscilloscope  Viva | 5 |
| 11 | Introduction to vacuum Technology | 6 |
| 12 | Performance of experiment Introduction to vacuum Technology | 7  7 |
| 13 | Solution of an equation by numerical method Ι | 8 |
| 14 | Solution of an equation by numerical method ΙΙ | 8 |