Learning Outcomes and RBPT Assignment

The aim of the Advanced Physics Laboratory course is to give students insights about key ideas from selected areas in the M.Sc. Physics curriculum through carefully designed experiments. As a part of this course, every student group carries out a set of experiments, collect meaningful data, analyzes it, and prepares a detailed written report. The faculty interacts with the student groups regularly to assess the understanding of the students both in terms of fundamental principles and the intricacies involved in assembling an experimental setup. The highlight of this laboratory is the capstone project every student group has to perform towards the final session of the course. In particular, this project is designed in a manner that tests the ability of students to solve open-ended problems that require efforts both in terms of learning the application of fundamental physics that they have learned as a part of the curriculum and also identifying new experimental tools required to solve the problem.

The expected learning outcomes from this laboratory course:

1. Ability to identify experimental techniques to solve a problem
2. Ability to connect theory with problems from real-life situations
3. Ability to channel the thinking that will lead to a solution for a particular problem
4. Ability to collect meaningful research data

Research-Based Pedagogical Assignment (RBPT)

Title:
Is there a correlation between the melting point, composition, structure, and taste of chocolates?

Context:
Chocolates play a major role in creating pleasant memories for a child as he/she transitions into the adult phase of his/her life. However, sometimes there are occasional disappointments whenever the taste of chocolates does not match the tastes imprinted in our memory from our childhood days. To share my own experience, I was very much thrilled by the taste of "Eclairs" my father used to buy for me once a month after he got his salary. My sister and I very much look forward to those "Éclair" days. However, my adulthood experiences with "Eclairs" chocolate never matched with those sweet memories as a school kid! There can be several factors that affect the taste of chocolates.

Problem:
Taste is a complex parameter to quantify. Nevertheless, I believe that there must exist a close connection between the ingredients used to make the chocolate and the processes used to make them into a form that reaches the market. I also believe that the way in which chocolates are packed and stored on the shelf of a store could also play a critical role in the user experience. For instance, the Diary milk chocolates stored in the refrigerator of a store might undergo multiple melting and solidification processes before it reaches our hand. In most situations, we will not know this fact while buying the chocolates. However, the taste of the chocolate cannot lie!. The task of each group is to carry out clever experiments on various types of chocolates and report on your observations and inferences on the various factors that could potentially affect the taste and quality of chocolates. You are free to choose chocolates of any brand.

However, confine your research to Chocolate bars like Cadbury Silk, Amul Milk Chocolate, Bournville etc., that are readily available.

Team Activities:

1. As a team, discuss, finalize, and procure the Chocolate samples required for the research.
2. Discuss and finalize the experimental methodology the team will adopt to find the factors that affect the taste of the chocolate.
3. Every team will identify a "taster" of the chocolate samples who will be kept blind about any details pertaining to the chocolate. For example, the team may decide to melt and solidify the chocolate several times before giving it for the "Chocolate tasting". The "taster" has to be someone who has not registered for the Advanced Physics Laboratory course. The "taster" must be a student residing on campus.
4. The team leader will update about the progress of the team once a week to the lab instructors. Teams can also discuss some useful experimental techniques required for the research with the lab instructors. Every team will report on the laboratory days (Tuesdays and Thursdays from 1 pm to 4 pm) and discuss the progress. The team leader has to ensure that every team member is contributing to the project.
5. Once the team gathers enough data to make meaningful conclusions from the research, they will prepare a 10-minute poster presentation and present it to the peer teams and the instructors.

Facilities for the research activities:

The Central Analytical Laboratory (CAL) of our campus will be made available to all the student teams. To access a particular facility in CAL, the student leaders need to contact the lab instructors early enough so that the teams can get a slot to do the necessary experiments. Please note that the facilities at CAL are very sophisticated and expensive, and therefore you have to be very careful while handling the equipment. In most situations, the technical staff at the CAL facility will do the experiments for you.