Syllabus in Advanced Chemistry
SY 2019-2020

I. Elective Subject Title: Advanced Chemistry (Product Development)

II. Subject Description:

This subject focuses on the design, testing, analysis of results, and reporting of developed chemical products. This subject introduces key ideas in analytical chemistry and experimental design to prepare students to become competent researchers, innovators, or prepare them for further studies in fields such as chemistry, chemical engineering, or statistics. This subject has a strong emphasis on research and shall require students to become competent in a chemistry laboratory as well as comfortable in using the R language for statistical computations. Students are expected to plan, design, fabricate and test their own chemical products in a project-based framework. Students are also trained to report their results across various channels.

III. Rationale:

*The Philippine Science High School SMC aims to inspire students to become scientists, innovators, and leaders in the country.*

*The program utilizes a project-based approach that engages students in meaningful learning experiences geared towards the development of critical thinking skills and instills in them humane and patriotic values as well as a world-conscious spirit. The program offers one (1) year of interdisciplinary chemical and statistical training aimed at the development of skills in research, experimental design, chemical (or, more generally, laboratory) analysis and scientific communication.*

IV. Subject Offering

| Grade Level | Subject Title | Number of meetings per week | Unit / Credit |
|---|---|---|---|
| Grade 10 | Elective (Advanced Chemistry) | 3 | 1 |

V. General Objectives:

At the end of the school year, the students should be able to:

1. Demonstrate knowledge of processes involved in the development of chemical products.

2. Manifest the ability to design, perform, and report chemical experiments related to developed chemical products.

3. Use the statistical language R to process experimental data.

4. Display awareness of scientific and mathematical/statistical factors involved in the development of chemical products.

## VI. Major Topics / Content

Quarter 1

1. Review of statistics (mean, standard deviation, confidence interval, t-test)
2. Introduction to experimental design (randomization, controls, hypotheses)
3. Block designs (Randomized Complete, Latin Square, Graeco-Latin Square, Balanced Incomplete Block Designs)
4. Factorial designs ($2^2$, General Factorial Designs)
5. Mixture designs
6. Literature Review (Review of journal articles and patents, processes)
7. Project proposal (Writing of SMART objectives, methods, costing, timelines)
8. Basic laboratory skills (Weight and volume measurements and transfers)
9. Sample and solution preparation (Sampling, homogenization, calibration, standardization)

Quarter 2

1. Analysis of Variance (and checking for adequacy for all experimental designs discussed)
2. Product fabrication pt. 1 (solubility and types of mixtures)
3. Product fabrication pt. 2 (common additives and solvents in food, drugs and cosmetics)
4. Module 1 (one of: spectroscopy, titration, polymers, natural products, solar cells, stability testing, microbial testing, as decided by students)
5. Module 2 (as before)

Quarter 3

1. Multiple comparisons (Fischer, Tukey etc. and Bonferroni correction)
2. Contour plots
3. Module 3
4. Product Testing

Quarter 4

1. Scientific paper writing (writing for the public and for publication)
2. Scientific presentation (oral and poster presentations)
3. Science and technology pitching

## VII. Requirements

Access to a scientific calculator and a computer with R/RStudio and Microsoft Excel is necessary.

A detailed report/output must be submitted each quarter:

Quarter 1: Project design and proposal
Quarter 2: Prototype
Quarter 3: Report of laboratory/panel testing
Quarter 4: Product Exhibit

VIII. Grading System

Pen and paper assessments (25%)
Alternative assessments (25%)
Laboratory outputs (25%)
Quarterly output (25%)

Prepared by:

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Date: August 5, 2019

Approved by:

AUG 05 2019

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