Subject Description Form

Subject Code	ABCT2422
Subject Title	Analytical Chemistry
Credit Value	4.0
Level	2
Pre-requisite / ~~Co-requisite/~~ ~~Exclusion~~	General Chemistry I
Objectives	This subject aims to familiarize students with the basic principles of analytical chemistry. Statistical methods of data treatment and analysis are introduced. The principles and applications of titrimetric methods, luminescence, UV-Visible and IR/FTIR spectrophotometry, and electrochemical methods are also introduced.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. understand the fundamental chemistry of aqueous solution and perform quantitative analysis using titrimetric methods; b. demonstrate knowledge in the basic principles and techniques of using luminescence, UV, IR/FTIR and electrochemical methods for analysis; c. recognize the advantages and limitations of each of the analytical methods discussed; d. conduct statistical analysis of measured data; e. apply and incorporate knowledge and skills learned to solve problems associated with chemical analysis; f. appreciate the importance of professional integrity.
Subject Synopsis/ Indicative Syllabus	<u>Experimental data analysis</u> Accuracy and precision, experimental errors, bias and uncertainty of measurement, significant figures; normal distribution and standard deviations; statistical methods of data treatment, regression and least-squares method, correlation coefficient; principles of estimation of measurement uncertainty. <u>Solutions and Titrimetric Analysis</u> Chemical equilibrium and equilibrium constants; ionic equilibrium and pH; principles of titrimetric analysis involving acid-base, oxidation-reduction, solubility equilibria, precipitation and complexometric reactions; concept of indicators; examples of common indicators and their applications; effects of electrolytes on chemical equilibria; applications of titrimetric analysis. <u>Electrochemical Methods</u> Electrochemical cells and electrode potentials; salt bridge and liquid junction; reference and indicator electrodes; measurements of cell

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<tr><td></td><td>potentials; potentiometric titration; basic principles of coulometric and voltammetric methods of analysis; conductance and conductivity; measurements of conductivity; applications of various electrochemical methods.

<u>Spectrochemical Analysis</u>
Electromagnetic spectrum; Beer's law; principles of absorption and luminescence spectrophotometry; spectrofluorometer; UV-Visible and IR/FTIR spectrophotometers; instrument components: radiation sources, monochromators and detectors; double-beam versus single-beam instruments; techniques in qualitative and quantitative analyses; applications of luminescence; UV-visible and IR/FTIR spectrophotometry.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td><u>Lectures:</u>
The fundamental chemistry of aqueous solution, the basic principles of titrimetric methods and instrumental techniques (e.g. luminescence, UV-Vis spectrophotometry, IR, electrochemical methods), statistical analysis of experimental data and their use in chemical analyses will be introduced in lectures.

<u>Tutorials:</u>
Tutorial questions will be used to help students gain a better understanding on the lecture materials. For example, common questions involving qualitative (e.g. titration) and quantitative analyses (e.g. concentration and weight percent of analytes) will be given to students for learning purposes.

<u>Practical classes (virtual lab.):</u>
Students will develop their practical skills and learn to apply different analytical techniques in laboratories.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td></tr>
<tr><td>1. Exam</td><td>65</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td></tr>
<tr><td>2. Test</td><td>30</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td></tr>
<tr><td>3. Lab</td><td>5</td><td></td><td>√</td><td></td><td></td><td></td><td>√</td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="6"></td></tr>
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Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Exam and tests will be used to assess students' understanding in various topics (e.g. fundamental chemistry, instrumental techniques, and qualitative and quantitative analyses) in this course. These tools will also be used to assess the ability of students to apply what they have learnt in solving problems involving</td></tr>
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<tr><td></td><td colspan="2">chemical analysis.

Students will need to work in groups to complete their lab work. Such practical training provides a good platform for students to develop their teamwork and communication skills. Students will also learn the importance of professional integrity through practical training (e.g. the proper ways of reporting and treating experimental data/results and lab safety).</td></tr>
<tr><td rowspan="8">Student Study Effort Expected</td><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lecture</td><td>26 Hrs.</td></tr>
<tr><td>▪ Tutorial</td><td>13 Hrs.</td></tr>
<tr><td>▪ Lab</td><td>10 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Self study
(reading on textbooks, reference books, reports etc)</td><td>78 Hrs.</td></tr>
<tr><td>▪ Lab reports</td><td>25 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>152 Hrs.</td></tr>
<tr><td>Reading List and References</td><td colspan="2"><u>Essential:</u>

Analytical Chemistry – An Introduction (7th ed.)

Skoog, D.A., West, D.M., Holler, F.J. and Crouch, S.R.
Publisher: Saunders College Publishing

<u>Supplementary:</u>

Principles of Instrumental Analysis (6th ed.)
Skoog, D.A., Holler, F.J. and Crouch, S.R.
Publisher: Brooks Cole

Analytical Chemistry for Technicians (3rd ed.)
Kenkel, J.
Publisher: Lewis Publishers

Analytical Chemistry of Foods
James, C.S.
Publisher: Blackie Academic & Professional</td></tr>
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