## **Subject Description Form**

| Subject Code                             | ABCT3741   |  |  |  |  |
|--|--|--|--|--|--|
| Subject Title                            | Analytical Chemistry II  |  |  |  |  |
| Credit Value                             | 3  |  |  |  |  |
| Level                                    | 3  |  |  |  |  |
| Pre-requisite                            | Analytical Chemistry I   |  |  |  |  |
| Objectives                               | This is an introductory course on instrumental methods of chemical analysis. Selected analytical techniques which are commonly used in the chemical laboratory will be introduced to students.   |  |  |  |  |
| Intended Learning                        | Upon completion of this subject, students will be able to:   |  |  |  |  |
| Outcomes                                 | a. demonstrate a good understanding on the basic concepts, principles and instrumentations of general techniques for chemical analysis, including atomic absorption and emission spectroscopy, molecular luminescence spectroscopy, gas chromatography, high-performance liquid chromatography, and relevant sample preparation; |  |  |  |  |
|  | b. recognize the advantages and limitations of each analytical technique;  |  |  |  |  |
|  | c. apply the knowledge gained to solve common and practical problems in chemical analysis.   |  |  |  |  |
| Subject Synopsis/<br>Indicative Syllabus | Overview of Chemical Analysis Test methods and validation; performance characteristics; quantitative methods; quality management and laboratory accreditation.   |  |  |  |  |
|  | Atomic Absorption and Emission Spectroscopy Basic concepts; comparison with molecular spectroscopy; components of atomic absorption/emission spectrometers; the flame and graphite furnace atomizers; the inductively-coupled plasma excitation source; interference effects; applications.                                      |  |  |  |  |
|  | Molecular Luminescence Spectroscopy Fluorescence and phosphorescence: basic principles, instrumentations and applications.   |  |  |  |  |
|  | Chromatographic Techniques Fundamentals of chromatography: the chromatographic process; general description of chromatography; column efficiency and resolution; the general chromatographic theory.   |  |  |  |  |
|  | Gas Chromatography: basic instrumentation; types of columns; choice of stationary phases; properties of thermal conductivity, flame ionization and electron capture detectors; temperature-programming, qualitative and  |  |  |  |  |

| quantitative analytical methodology.  |   |  |   |   |   |  |  |
|---|---|--|---|---|---|--|--|
| High-Performance Liquid Chromatography: development of liquid chromatography; instrumentation; adsorption chromatography; partition chromatography; ion exchange chromatography; size exclusion chromatography; other chromatographic techniques.  Sample Preparation Techniques  |   |  |   |   |   |  |  |
| Solid-liquid extraction, batch extraction, continuous extraction, selection of solvents; liquid-liquid extraction, acid-base extraction; gel permeation chromatographic cleanup, solid phase extraction cleanup.  |   |  |   |   |   |  |  |
| <b>Lecture</b> : basic principles and instrumentations will be introduced and discussed. Examples will be used to illustrate the applications of various techniques.  |   |  |   |   |   |  |  |
| <b>Tutorials:</b> a set of tutorial problems will be given to allow students to apply the knowledge acquired from the lectures. Students are encouraged to solve the problems before seeking assistance. These will help students consolidate what they have learned and develop a deeper understanding of the subject. |   |  |   |   |   |  |  |
| Specific assessment methods/tasks   | %<br>weighting  | be ass   | Intended subject learning outcomes to be assessed (Please tick as appropriate)  |   |   | nes to   |  |
|   |   | a  | b   | c   |   |  |  |
| 1. Exam   | 40  | √  | √   | <b>√</b>  |   |  |  |
| 2. Test   | 60  | V  | V   | V   |   |  |  |
| Total   | 100 %   |  | I   | 1   | 1   | 1  | 1  |
| Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:  Test and examination are used to evaluate how much students have learned in principles and applications of various techniques.   |   |  |   |   |   |  |  |
| Class contact:  |   |  |   |   |   |  |  |
| ■ Lecture   |   |  |   |   | 26 Hrs.   |  |  |
| ■ Tutorial  |   |  |   |   | 13 Hrs.   |  |  |
| Other student study effort:   |   |  |   |   |   |  |  |
| <ul> <li>Self study</li> </ul>  |   |  |   |   | 72 Hrs.   |  |  |
|   | High-Performance Liquichromatography; instruction of section at a set of solvents; liquid-liquichromatographic clean discussed. Examples we techniques.  Tutorials: a set of tuto apply the knowledge at to solve the problems be consolidate what they for the subject.  Specific assessment methods/tasks  1. Exam  2. Test  Total  Explanation of the appropriate and examination are principles and application.  Class contact:  Lecture  Tutorial  Other student study effort | High-Performance Liquid Chromatochromatography; instrumentation; a chromatography; ion exchange chrochromatography; other chromatography; other chromatographic cleanup, solid phase Lecture: basic principles and instrudiscussed. Examples will be used to techniques.  Tutorials: a set of tutorial problems apply the knowledge acquired from to solve the problems before seeking consolidate what they have learned of the subject.  Specific assessment methods/tasks weighting  1. Exam 40  2. Test 60  Total 100 %  Explanation of the appropriateness of the intended learning outcomes: Test and examination are used to evaluate principles and applications of various the contact:  Lecture  Tutorial  Other student study effort: | High-Performance Liquid Chromatograph chromatography; instrumentation; adsorpt chromatography; ion exchange chromatographic to the Sample Preparation Techniques Solid-liquid extraction, batch extraction, acid-chromatographic cleanup, solid phase extraction acid-chromatographic cleanup, solid phase extraction, acid-chromatographic cleanup, solid phase extraction acid-chromatographic cleanup, solid phase extraction, acid-chromatographic cleanup, solid phase extraction, acid-chromatographic cleanup, solid phase extraction acid-chromatographic deviation acid-chromatographic deviation acid-chromatographic deviation acid-chromatographic deviation acid-chromatographic deviation acid-chromatographic deviation, acid-chromatographic deviation acid- | High-Performance Liquid Chromatography: dev chromatography; instrumentation; adsorption che chromatography; on exchange chromatography chromatography; other chromatographic techniques  Solid-liquid extraction, batch extraction, contimof solvents; liquid-liquid extraction, acid-base echromatographic cleanup, solid phase extraction  Lecture: basic principles and instrumentations voliscussed. Examples will be used to illustrate the techniques.  Tutorials: a set of tutorial problems will be given apply the knowledge acquired from the lectures. to solve the problems before seeking assistance. consolidate what they have learned and develop of the subject.  Specific assessment methods/tasks weighting be assessed appropriate)  1. Exam 40 √ √  2. Test 60 √ √  Total 100 %  Explanation of the appropriateness of the assessment intended learning outcomes:  Test and examination are used to evaluate how much principles and applications of various techniques.  Class contact:  Lecture  Tutorial  Other student study effort: | High-Performance Liquid Chromatography: developm chromatography; instrumentation; adsorption chromatochromatography; ion exchange chromatography; size exchromatography; other chromatographic techniques.  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|                             | Total student study effort  | 111 Hrs. |
|-----------------------------|---|----------|
| Reading List and References | Essential:  Principles of Instrumental Analysis (7 <sup>th</sup> ed.) Skoog, D. A.; Holler, F. J. and Crouch, S. R Cengage Learning, 2017.  Supplementary: Introduction to Instrumental Analysis Braun R. D. BSP Books, 2019. |          |